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JOURNAL OF THE COOPER ORNITHOLOGICAL CLUB

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BLACK-BELLIED TREE DUCK, *DENDROCYGNA AUTUMNALIS*

Two-fifths natural size

Painted in 1868 by Andrew Jackson Grayson

THE CONDOR

VOLUME 51 SEPTEMBER-OCTOBER, 1949 NUMBER 5

OBSERVATIONS ON BEHAVIOR AND POPULATIONS OF OYSTER-CATCHERS IN LOWER CALIFORNIA

By KARL W. KENYON

The following observations of oyster-catchers were recorded mostly during April and early May of 1946 along the Pacific shore of the northern half of the peninsula of Lower California. They are concerned largely with the distribution and behavior of the mixed population of Pied and Black oyster-catchers (*Haematopus ostralegus frazari* and *H. o. bachmani*) of that area. These two forms have long been regarded as distinct species, but they are now known to hybridize or intergrade.

POPULATIONS

The number of oyster-catchers inhabiting the northwest coast of the peninsula and adjacent islands appears to have become somewhat reduced in some areas since previous observations near the beginning of the present century. In other areas little change is indicated. My observations duplicated, in general, those recorded by earlier observers concerning the interbreeding of typical *bachmani* and *frazari*, producing intermediate individuals in this area. On rocky shores *bachmani* appears more abundant while *frazari* predominates on sandy areas.

I visited Los Coronados Islands twice in the spring and summer of 1946. On March 27, I visited the North Island only and saw no oyster-catchers. Likewise, I saw none here when I returned to the island on July 22, 1946. Grinnell and Daggett (1903:33) stopped at this island in August of 1902 and found both "species" present.

On July 23 and 24, I visited both of the small middle islands and found six oyster-catchers which appeared to divide their time between the two small islands. At least two of the birds were immature. One of the adults was typical *bachmani*, while the others ranged through intermediate forms to almost typical *frazari*. I found a dead immature bird well back in a dark cave on the small middle island.

Although the population on the Coronados appears to have become reduced in size since the early nineteen hundreds, Mr. L. M. Huey (letter, 1948) states that he has observed a fluctuation from year to year in the number of birds inhabiting the islands during his more than thirty years of experience in this area. This fluctuation in numbers was definitely the result of collecting in one instance. The birds appear to re-establish themselves relatively slowly, probably because this area is quite a distance from the center of abundance, a hundred or more miles south of the Coronados.

I was on San Martín Island from the 4th through the 8th of April, and during this time covered its coast line carefully. However, I failed to find any oyster-catchers. Kaeding (1905:111) found them common here in 1897 as did Gifford (1913:53) in July of 1905. It is interesting to note that the Osprey (*Pandion haliaëtus*) shows a great decrease in population on this island in the same period (Kenyon, 1946:153).

While on the small rocky island of San Geronimo, April 11 to 14, I found a population of three mated pairs of oyster-catchers. Four of these birds appeared completely black while two were intermediate or pied individuals. One of the latter had a completely

white belly, while the other had an irregular white patch on the breast and belly. Two of the dark-colored birds were mated, while each of the other two pairs included a dark and a pied bird. Willett (1913:22) stated that he collected a similar pair of birds here. Gifford (1913:53) recorded that during his visit on July 13, 1905, twelve Black and eight Pied oyster-catchers were counted. If the nesting season of 1946 was successful, the July population on the island was probably close to the population found by Gifford.

Scammon Lagoon supports the largest population of oyster-catchers of any of the

Fig. 32. Sand and shell spit, Shell Island, Scammon Lagoon, showing type of beach used by nesting oyster-catchers of this area.

areas I visited. Shell Island (the names used for the small islets of this lagoon are those commonly employed by the fisherman of the area), the largest and most thickly populated islet, had 23 mated pairs. Apparently several unmated individuals occupied the island also. Two birds from this entire group were entirely black. These individuals occupied territories at quite a distance from each other. Both had mates which appeared to be typical *frazari*.

Three other islets in this lagoon, which I visited, supported smaller populations. Rock Island, which was infested with coyotes, had four pairs, Nest Island an estimated eight pairs, and Box Island an estimated twelve pairs. Short visits only were made to the last-named islets, thus an accurate count was not possible.

The total population of the area of Scammon Lagoon thus consisted of approximately 47 pairs. In addition to these I saw a few birds which appeared to be unmated. Bancroft (1927:51) estimated that in Scammon Lagoon "There are at least two or three hundred oyster-catchers fairly evenly distributed over the islands we visited . . . ." In 1946 the coyotes on Rock Island may have accounted for quite a reduction in the population of that island. The birds of Scammon Lagoon, as nearly as could be observed in the field, were mostly typical *frazari*, the others showing variable amounts of dark coloration. I saw only the two completely black specimens mentioned above.

Several pairs of oyster-catchers, all showing a good deal of white, inhabited the southeastern end of Natividad Island. I made no attempt to explore completely the steep

and rocky coast line of this island. Thus, even the estimate of four to six pairs here was largely a guess. Chester C. Lamb (1927:70) remarks on the oyster-catchers of Natividad that equal numbers of black and pied individuals were present. In 1946 the island was heavily infested with house cats. It is possible that the oyster-catchers as well as the Black-vented Shearwaters, *Puffinus opisthomelas*, which nest there are suffering from their depredations.

NESTING IN SCAMMON LAGOON

On April 20 I carried out quite a thorough search for eggs on Shell Island (fig. 32). This island is a low sand and shell (*Pecten circularis*) spit approximately three-quarters

Fig. 33. Nest of the Pied Oyster-catcher, Shell Island, partly protected from wind by a piece of dried gut of a green turtle. Photo by Milo W. Williams.

of a mile long. Because of tidal action, its shape is variable, and no accurate charts of it are available. At no point is it more than two or three feet above high water and on its eastern side, it is bordered by a salt marsh and sand flats.

Egg laying apparently began about the 20th of April in the Scammon Lagoon area. A number of nests, frequently within a few feet of each other, had been completed and appeared ready to receive eggs. Many of these were probably "play nests" (nests built during courtship but not used for eggs). I found only two nests with eggs. Each contained one egg. A Mexican fisherman, who had frequently hunted for eggs of the Royal Tern (*Thalasseus maximus*) in the previous weeks, accompanied me and appeared quite surprised at this new type of egg, which he said he had not found before. By the 24th of April we found seven nests with eggs. These all belonged to birds appearing to be typical *frazari*. By the 26th, when I made the last general tour of the island to check on these nests, I found that two of those discovered on the 23rd with one egg still contained only one egg. The other five each contained two eggs (fig. 33). Apparently the Frazar Oyster-catcher of this area averages fewer eggs per clutch than the Black Oyster-catcher of the Sitka region which Webster (1941:142-143) studied. He found that of thirteen first sets examined the average number per set was 2.69 eggs.

After April 24, I was unable to spend time searching for additional nests. A nest on a finger of sand near the fishermen's camp was under intermittent observation until May 6. During the night of May 2 an exceptionally high tide flooded areas which had apparently not been touched by tidal water previously during the season. The water

covered the nest occupied by this pair of oyster-catchers. On the morning of May 3, when I again visited the nest, I found that the birds had moved their eggs up the gently sloping sand and shell beach a distance of seven feet and were incubating just beyond the high-water mark.

Wishing to observe the birds more closely, I set up my burlap blind about ten feet from this new nest site. The birds shied away from the blind, refusing to approach close enough to sit on the eggs. However, after circling the area several times, meanwhile pecking at the sand and indulging in several piping performances, the bird desiring to to incubate approached the eggs and settled on the sand about six inches from them. The eggs were thus just within reach of the tip of the bill. Reaching over an egg with the bill it was rolled across the sand and tucked under the breast feathers. After an interval of three minutes, during which time the bird gazed steadily at the blind, the other was procured in the same manner.

High tides occurred again during the nights of May 3 and 4. When I last visited the nest on May 5, I found that the high tides had forced the oyster-catchers to move their eggs even farther up the beach. They now rested ten feet from the position of the original nest.

Despite the many disturbances forced on these birds by the tide, the proximity of the fishermen's camp, and by my observation blind, they continued to incubate all day on the 5th. On the 6th they appeared to lose interest in their eggs. Both birds continued to remain in their territory during the day and engaged in frequent piping performances between themselves and the neighboring pair. Early on the morning of May 7, we left Scammon Lagoon, ending my observations on this nest.

Territorial behavior was observed as frequently as possible in an attempt to chart accurately the nesting territories held by the various mated pairs (fig. 34). "Play nests" were found in all of the areas charted. Although the small size of the low sandy island, approximately three-quarters of a mile long, caused the birds occupying it to crowd their home areas rather closely together, the feeding grounds were widely dispersed. During low water many miles of sand flats were exposed in all directions from the island. As the tide receded the birds waited patiently for their particular feeding ground to become exposed, then left quietly, either singly or in two's, taking a direct route for the distant feeding area.

The pair of oyster-catchers mentioned above and easily seen from the fishermen's camp was the one most frequently watched. On several occasions I saw them leave for the feeding grounds together, apparently relying on the sun to keep the eggs warm in their absence. Webster (1941:150) found that the Black Oyster-catchers of the Sitka region did not leave their eggs uncovered even on the warmest days.

One afternoon when the sun was shining and the tide was out and both oyster-catchers of this nest were feeding on the sand flats, I watched a Raven (*Corvus corax*), which was picking over a heap of green turtle shells and bones near the fishermen's camp. Suddenly taking to the air he headed directly for the oyster-catchers' nest. He glided low over the sand but instead of flying to the nest, alighted on the beach about fifty feet from it, then proceeded to amble toward the unprotected eggs. Neither of the oyster-catchers was in sight when the Raven alighted. As he took his first steps toward the nest I caught sight of the pair rapidly flying toward their nest. They skimmed low over the distant sand and water patches and looked so far away that it seemed they had little chance of reaching the Raven before he found the eggs. Yet the birds arrived while the marauder was still five or six feet from his objective. The first of the pair took up the attack by making a low sweep at the Raven while the other bird added its shrill calls

to those of its more aggressive mate. The Raven ducked, frantically prostrating himself, so that a little white splash of sand was thrown up where his bill hit. After delivering the initial attack the oyster-catcher pulled sharply upward completing a steep, 180-degree, climbing turn, which brought it again into position to deliver a fresh attack. The attacks were delivered up wind. Five low sweeps were completed before the Raven took flight. Between each dive he continued to amble toward the nest, throwing himself flat on the sand each time it seemed that the swooping oyster-catcher would hit him. When finally driven away the Raven was within a foot or two of the nest.

Fig. 34. Sketch-map of Shell Island, Scammon Lagoon, showing approximate territorial boundaries (broken lines) of the 23 mated pairs occupying the island in spring of 1946. The beach line is indicated by a solid line. A small square near south end indicates location of fisherman's camp.

As soon as the Raven was in the air both birds pressed an angry assault. The aerial attacks were delivered as "lowside beam runs"; that is, the attacking bird flew at the Raven from the side and slightly below, coming so close that at least once the wings of attacker and attacked met with an audible slap. After each assault the attacking bird pulled sharply up to an altitude of 20 or 30 feet above the Raven, completing a steep climbing turn, then after flying back across the flight path of the Raven it entered a steep dive, making another pass. The attacks were continued with constant loud cries until the Raven had been driven 100 yards or more from the nesting territory.

Apparently the egg-robbing technique of the Ravens of the Sitka region is more successful. According to Webster (1941:146) Ravens wait on an elevated position, then

fly directly to the nest and spear an egg while the oyster-catchers are involved with other maruaders. No elevated places are available in Scammon Lagoon from which to watch, thus the Raven perhaps did not know the exact location of the nest and could not fly directly to it.

After driving the Raven away the oyster-catchers returned to their nesting territory and indulged in a typical piping performance. The bills were pointed stiffly and at a sharp angle downward, tips just clearing the sand, the neck feathers were ruffled, the tail was pointed sharply upward and the wings drooped. Holding this posture the birds ran about near each other in a stiff little dance, uttering a sharp piping call.

The enemies of the oyster-catchers in Scammon Lagoon appear to be limited to the Raven and the Western Gull (*Larus occidentalis*). The Ospreys and oyster-catchers nest in close proximity, showing no concern for one another. The Ravens probably do more damage than the gulls since they appear to remember the location of the nest to some extent while the gulls do not. The latter birds frequently flew over oyster-catchers' nests both while the birds were incubating and while the eggs were left uncovered, yet the only time that the gulls actually showed an interest in the eggs was when the oyster-catchers were defending their territory from the Ravens. Only one nest which I found on Shell Island was destroyed. This particular nest was the nearest to the fishermen's camp and the birds were constantly disturbed.

PIPING BEHAVIOR

The piping performances, both aerial and terrestrial, which are engaged in as expressions of many emotional situations, appear to be quite similar in the birds of Scammon Lagoon to those described for other members of this genus by Huxley and Montague (1925) and others. The Black Oyster-catchers of the Scammon Lagoon area took part in piping performances with typical individuals of *frazari*. The behavior and vocal expressions of the two were identical as far as I was able to tell. During my stay in Scammon Lagoon, it was usual to see from two to six oyster-catchers engaged in a piping performance. Such groups would fly in close formation out over the water, then return to the beach where they would assume the typical piping posture as already described.

The two pairs occupying territories nearest the fishermen's camp joined together in their piping performances. After the initial flight they usually landed at a point through which an invisible line between their two territories appeared to pass. Here the members of opposing pairs would face each other and go through a typical piping dance. These performances continued after the already mentioned destruction of the eggs of one pair.

The oyster-catchers continue their activities at all hours of the night. Unfortunately, the sky in the vicinity of Scammon Lagoon was invariably heavily blanketed with clouds at night during our stay there. For this reason I could only depend on sounds to know what the birds were doing. Judging from their calls they engaged in piping flights much the same at night as those observed in the daylight. We lay at anchor about 200 feet from the beach. The calling birds circled out around our position, then back to the beach.

SUMMARY

The population of Pied and Black oyster-catchers along the Pacific shores of the upper half of the peninsula of Lower California, Mexico, appears in some places to be unchanged; in other areas it is reduced from that recorded by others in this region in the early part of the present century. One outstanding case was noted: The island of San Martín had no oyster-catchers in 1946 whereas in past years it had many birds.

Scammon Lagoon harbors the most concentrated breeding population of oyster-catchers. An estimated 47 pairs were observed in this area in the spring of 1946.

In 1946, egg-laying began about the 20th of April in the Scammon Lagoon area. Of seven nests observed until egg-laying had been completed, five had two eggs and two contained one egg only.

A pair of oyster-catchers moved their eggs a distance of ten feet in a period of approximately three days to avoid high nocturnal tides. An oyster-catcher was observed to move its eggs by rolling them with the tip of the bill.

Although the nesting areas are close together, the feeding grounds of the individual pairs are widely separated from them. Sometimes both birds of a pair will leave their eggs and visit the feeding grounds together.

Oyster-catchers followed definite patterns of attack while driving a Raven away from the nesting territory.

Piping performances were observed frequently after egg laying had taken place. The few Black Oyster-catchers seen followed the same behavior patterns, as far as observations were carried, as did the Pied Oyster-catchers with which they were mated.

The oyster-catchers of Scammon Lagoon apparently made frequent nocturnal flights. These flights were accompanied by the vocal sounds typical of the diurnal piping performances.

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U. S. Fish and Wildlife Service, Seattle, Washington, February 8, 1949.

THE ENDEMIC AVIFAUNA OF SAIPAN, TINIAN, GUAM AND PALAU

By JOE T. MARSHALL, JR.

In the year from December, 1944, to December, 1945, I made a zoological collection, chiefly animals of medical interest, on the islands of Saipan, Tinian, Guam and Palau in Micronesia. These were obtained for the United States Army Medical Museum. Birds were collected incidentally to procuring a collection of mammals and their ectoparasites; they were turned over to the United States National Museum by the Army Medical Museum. Richard E. Genelly worked with me on Tinian and generously provided the photographs used in this paper. In my spare time I recorded field observations and prepared series of study skins, some skeletons and alcoholics of birds which were sent to the Museum of Vertebrate Zoology. Through the courtesy of Herbert Friedmann of the United States National Museum the first-mentioned bird skins were loaned to the Museum of Vertebrate Zoology where the following account of the endemic land and fresh-water species was prepared. It is based upon the 579 specimens collected by Genelly and myself and upon my field notes. An effort was made to obtain the maximum information possible from each bird specimen. Color of soft parts, degree of completion of the skull roof, size of gonads, stomach contents, amount of fat and stage in the molt sequence were recorded. I searched also for blood parasites in the species taken on Saipan and Tinian. Further information was obtained, though not reported here. Samuel A. Edgar identified intestinal parasites and Henry S. Dybas identified arthropods in the stomachs and collected ectoparasites, which were sent to the National Museum.

HABITATS

The native land and fresh-water birds of these islands are either confined entirely to natural environment or achieve their maximum abundance in it, with one exception. On Tinian, rows of acacia trees have been planted as windbreaks through the farm lands, and the resulting "edge" habitat is particularly suitable for the Bridled White-eye, which occurs therefore in disproportionately large numbers on Tinian as compared with the other islands.

The untouched natural environment may be divided into several kinds of habitat as follows. (1) Mangrove lagoons occur over vast areas in the Palau group. They provide a stand of vegetation suitable for many land birds, consisting of two sizes of trees, spaced several yards apart, growing in three to six feet of salt water. One is an erect tree with a single straight trunk 30 to 50 feet high, the other forms dense clumps of multiple stems only 10 to 15 feet tall.

(2) Coastal shrubbery occurs on Saipan, Tinian, and Guam (fig. 35). It often is wind-controlled, and forms a dense, continuous cover of broad-leaved plants three to six feet tall in a band along the coast in places with too little soil and too rocky to support trees.

(3) An entirely different kind of coastal vegetation occurs on all the islands at the edge of sandy beaches where there is ample soil on gently sloping ground. It consists of a row or two of magnificent Casuarina trees, often more than 100 feet tall.

(4) Fresh-water marshes are found on Saipan, Tinian and Guam. At Lake Susupe (actually brackish), Saipan, and Lake Hagoi, Tinian, the marsh vegetation consists of alternating pure expanses of cane about 10 feet tall, tules about six feet tall, and fern-like plants whose fronds interlock to form an impenetrable mass extending from six to ten feet above the water level.

(5) Savannah is found near the airstrip on Babelthuap, Palau, and consists of bunch grasses and ferns two or three feet high separated from each other by bare soil.

(6) Woodland covers the major portion of the islands (fig. 36). A rich assortment of broad-leaved trees, differing somewhat as to component species on each island, grow close together and provide a continuous leafy canopy 30 to 100 feet above the ground. On Palau this forest is densest, and there is only a sparse understory vegetation. Here the forest is composed of two elements: gigantic multiple-stemmed trees with widely spreading dense crowns, growing about 100 yards apart and extending high above the level of the surrounding vegetation; and shorter trees forming a more or less interrupted canopy between the former, depending on the irregularities and steepness of the terrain.

ENDEMIC SPECIES

The little Pied Cormorant (*Phalacrocorax melanoleucus*) is found on Palau in mangrove lagoons and small fresh-water ponds inland where they spend much time sitting upright on dead branches. Individuals or small groups are often seen in flight over the inland forests. A specimen taken from a tree at the edge of a stream on Babelthuap had eaten a crayfish.

Fig. 35. Coastal shrubbery at Marpo Point, Tinian Island.

The Reef Heron (*Demigretta sacra*) was seen only once on Saipan (gray phase). It was found nesting in April on Tinian by Genelly (birds were gray-colored; fig. 37) and was watched foraging in lagoons on Guam. Here the birds had been spending the heat of the day standing singly or in pairs on the sandy beach. Later in the afternoon until almost dark they actively stalked small fish in water a foot deep, keeping always on the move and working out to 100 yards from shore. On Palau the Reef Heron forages also in mangrove lagoons, where a white individual with black shaft spots on the back and wings was found creeping about in shallow water, keeping the body horizontal, low, and with the neck hunched up. It would strike at a fish by "releasing" the head, as if by trigger action, in a forward and downward direction. Of nine birds seen on Palau, five were gray, two pure white and two were white with black spots on the back.

The Rufous Night Heron (*Nycticorax caledonicus*) was noted in mangrove lagoons on Palau. At dusk they fly for long distances over the forest to their feeding grounds. In view of the surpassing beauty of the plumage of this species, it might be of interest to note the equal delicacy of color of the soft parts: iris yellow, skin on face lettuce green, bill black and feet creamy yellow.

The Chinese Least Bittern (*Ixobrychus sinensis*) is an abundant and conspicuous inhabitant of fresh-water marshes on Saipan, Tinian and Guam. Only two were seen on Palau. On Guam these bitterns appear in the evenings in lagoons and feed in company

Fig. 36. Cane field and broken forest, in vicinity of coral caves near northwest end of Tinian Island.

with the Reef Herons, pursuing small fish in a manner identical to that species, while they wade in water up to their bellies. They also feed on grasshoppers in moist grassland near marshes and are frequently seen during the day making long flights over the farm lands. A more characteristic forage behavior is noted in the tule beds around the lakes on Saipan and Tinian. The bird grasps a tule stem in each foot and moves from stem to stem about a foot above the water level. It comes to the edge of the tules to feed, where it sits absolutely motionless in a compact ball with the head drawn in against the body. The feet extend almost horizontally to each side because of the bending of the two stems which it grasps. With a movement of extreme rapidity it suddenly extends its long neck to grasp a small fish in its bill. It can retire into the inner tules and back again with such a fluid easy grace that one does not suspect the bird to be in motion until it vanishes. The call, frequently uttered, is a harsh *craak*.

The Marianas Mallard (*Anas oustaleti*) is found in fresh-water marshes at Lake Susupe, Saipan and Lake Hagoi, Tinian (fig. 38). Twelve was the greatest number seen together at any one time. They were never found on both the lakes during any one month, and it is probable that the same birds fly from one island to the other. An adult male taken in April and another in October were both in breeding condition. A family of ducklings was seen in April. They are frequently found in pairs, not out on open water but in little ponds completely surrounded by tules. When flushed, they circle the lake and land in

concealed ponds at the other end. This mallard feeds on green vegetation and seeds by plucking away at the grass in very shallow water. No "tip-up" feeding was seen.

The Incubator Bird (*Megapodius lapérouse*) was found only on Palau. There was no trace of them on Saipan, Tinian or Guam; they were once abundant on at least the first two islands. Genelly and I searched every bit of the remaining natural forest on Tinian, the type locality of the race *lapérouse*, including some particularly fine timber

Fig. 37. Reef Heron (gray phase) on nest, Tinian Island.

on the northeast side (fig. 39). In considering the habitat of the Incubator Bird (as well as the Palau Ground Dove) on Palau, a distinction must be made between two kinds of woodland. Particularly luxurious stands of timber grow on the rich deep soil of the gently sloping mountains of Babelthuap. I found neither of these bird species there although a careful search was made. On the smaller islets adjacent to Babelthuap, such as Koror, the forest grows on knife-edged steep ridges which are rocky, are practically without soil, and are dissected by fissures, potholes, narrow ravines and caves. A little soil and leaf mold collects on the tops of flat boulders and in the bottoms of the ravines, thus providing the sole niche for foraging by megapodes and ground doves. Incubator birds are abundant in this kind of forest, scratching in the leaf litter on the ground for their food of small fruits and snails. Their ease of locomotion on the rocks is uncanny. In the gloom under the forest canopy, a bird walking in a horizontal direction, say along the jagged wall of a ravine, appears to progress rapidly, steadily and gracefully as if a smooth trail had been hewn from the rock for his accommodation. Judging from tracks, they go under and among boulders. The principal sign of their activity is the kicked-up soil and leaf litter found on every flat bench or ravine bottom. They roam singly or in small groups, but the chicks appear to be solitary and independent. Both adults and chicks fly rapidly and perch quietly in trees when flushed. Two kinds of loud call-notes are uttered by this species, either separately by the same individual or as a duet. One bird

gives six staccato notes on the same pitch (*cuk-cuk-cuk-cuk-cuk-cuk*) while the other chimes in with three long cries, each with a downward inflection and lower in pitch than the preceding (*keer, keer, keer*).

The Banded Rail (*Rallus philippensis*) is abundant on Palau in savannah vegetation, around the edges of mangrove lagoons and in grassland of abandoned farms, where it feeds on green vegetation and snails. In the evening, dozens of birds can be heard as they call with a piercing *kreek, kreek, kreek*. I have never seen this bird fly. It forages on the ground, walking and moving the head back and forth with each step. When surprised, it scoots along rapidly with the head hunched down.

The Guam Rail (*Rallus owstoni*) is found in grass and ferns on damp ground on the edges of clearings in the woodland on Guam. Downy young utter a single light *"tsip"* note which sounds like the call of the Orange-crowned Warbler in California. The only food item I have noted is a kind of leathery land slug.

Fig. 38. Marianas Mallard, a sick individual in a fresh-water lake on Tinian Island.

The Gallinule (*Gallinula chloropus*) is abundant in the fresh-water marshes on Saipan, Tinian and Guam. One was picked up dead on Palau. They feed in the water by swimming and sticking the head under the surface to grasp green vegetation, or they pick seeds and insects from the ground as they walk through the cane, with tail up and flashing the white feathers constantly. I did not visit the fresh- and brackish-water marshes on Palau and so failed to find these birds alive there. Rollin H. Baker (Smithsonian Misc. Coll. 107, no. 15, 1948:49) provides evidence that they breed on this island group.

A Palau resident which I happened not to find is the Purple Swamphen, *Porphyrio porphyrio*, included here for the sake of completeness. Baker (*loc. cit.*) has recorded it and reliable observers at Peliliu noted it during my stay there.

Fruit doves of the genus *Ptilinopus* are exceedingly abundant, strictly arboreal inhabitants of the woodland environment on Saipan, Tinian, Guam and Palau. They usually feed in the upper parts of the trees and procure their food of fruit, berries, small figs and flowers by walking along horizontal twigs and reaching up and to the side to pick fruit. Each time a fruit is plucked, the foliage shakes a little, and this is practically the only indication of the presence of the doves. They are almost invisible in the trees by virtue of their light green coloration. Their short fleshy tarsi appear to equip them admirably for locomotion along horizontal twigs and branches. The birds generally alight perching crosswise on a twig, then turn and move off along it. They can turn entirely

around with singular grace and economy of motion and move in the opposite direction. They have two equally baffling tricks to avoid detection when first entering a tree. Either they freeze for 15 minutes upon alighting, which amounts to vanishing because of their concealing coloration, or they alight and repair, in the same continuity of motion, to further concealment in the foliage, then freeze.

When a group has once started feeding in a very tall tree the birds are no longer wary. In lower trees they leave silently out the back side of the tree as the observer approaches. They fly at great speed and very straight, always at tree-top level. There appears to be no particular flocking tendency but because of the great numbers of individuals, any food tree, especially those on Palau whose spreading crowns project high above the general forest level, will have up to a dozen birds in it.

Fig. 39. View of part of largest area of undisturbed forest (right center) on Tinian Island.

On Palau the fruit doves share this particular forage niche with the Micronesian Pigeon, but the two species tackle the food problem in different ways. The former work from within, the latter from the periphery of the tree. Groups of the two species often feed in the same tree, but they pay no attention to each other. Fruit doves frequent not only the woodland but also, on Saipan, the *Casuarina* trees at the shore of Lake Susupe, and on Palau, the larger trees in the mangrove lagoons. Birds ply back and forth constantly between woodland and lagoon.

In the foregoing discussion I have combined information on the Marianas Fruit Dove (*Ptilinopus roseicapilla*) of Saipan, Tinian and Guam and the Crimson-crowned Fruit Dove (*Ptilinopus porphyraceus pelewensis*) of Palau because I think they are practically identical in ecology and behavior. The only difference in behavior discerned is in their songs, which differ in tempo and inflection although not in quality. In *roseicapilla* the sequence of mellow "coo's," all beginning on the same pitch, starts with two or three long notes, definitely separated from each other, each inflected upward in the middle. This inflection imparts to the opening notes a particularly "demanding" or

"insistent" character. They are followed by a rolling series of notes becoming faster, then slower toward the end, followed by three or four longer notes with rising inflection. This song, heard all day long, can be represented thus (commas indicate pauses): *cooo, cooo, cooo, cu-cucucucu-cu-cu coo coo coo*. On the other hand, all the notes in the song of *pelewensis* have a downward inflection, are distinct and separate from each other, with hesitations in the first part of the song and a descent in pitch in the last part (an asterisk denotes a hesitation): *coo, coo,* coo-cu,* coo, coo-cu,* coo* (now an even descent in pitch) *cu, cu, cu, cu, cu*. This song, on Koror in the Palau group, is heard all day and all night. I would guess that nocturnal singing is not spontaneous but is provoked by outside agencies, namely imitated calls by myself or the opening notes of the song of the Palau Owl, which are of similar pitch and quality to those of the dove. This provocation is always forthcoming from the owls, which abound in the same habitat occupied by the doves. The fruit dove can then be regarded as being irresistibly impelled to answer notes similar to its own. One dove will answer the first owl, then the whole island is in an uproar. Each dove gives only one sequence, then is silent until a new outbreak is initiated.

The Micronesian Pigeon (*Ducula oceanica*) is also strictly arboreal and is abundant in woodland on Palau. Unlike the Crimson-crowned Fruit Dove and the fruit bat (*Pteropus mariannus*) it does not forage both in the woodland and mangrove lagoons. It eats much larger fruit than does *Ptilinopus* although small berries are also taken. Each fruit is swallowed whole; the pits, 23 mm. in diameter, are to be found in the stomach and intestine. These birds commonly gobble fruit while they cling to little twigs on the periphery of the tree, often hanging upside down; or by fluttering the wings they maintain the body in a vertical position. They are evenly distributed through the forest and were not flocking in November and December. They prefer to sing from the tops of ridges; therefore there is usually a great concentration of birds along the forested crests. Adults are wary and call from concealment in the higher parts of the trees, whereas the young birds, lacking the knob on the bill, are tame and are more frequently collected. The song, resembling the barking of sea-lions, is a rasping, deep-throated *arrooo, arrooo, arooo, aroo, aroo*, consisting of three to seven notes each lower in pitch, shorter and of less intensity than the preceding. At close range a superimposed tone of rising inflection can be heard accompanying each bark; it is a high-pitched rasp similar to the song of a tree frog (*Hyla*) and can be represented as *kreek, kreek*. Another song heard less frequently is a series of mellow hoots all on the same pitch and in tempo identical with the barking song.

The White-throated Dove (*Gallicolumba xanthonura*) is strictly arboreal and is abundant on Saipan, Tinian and Guam, although less numerous than *Ptilinopus*. One's first introduction to this species is the sight of lone males flying for long distances high over valleys and ridges with a peculiar labored effort, very slow in spite of the vigorous deep strokes of the wings. The body is inclined upward from the horizontal, and the whole performance gives the impression of a bird fighting a tremendous head-wind. This dove feeds on fruits, seeds and berries which it swallows whole, although at times it picks at the pulp and seeds of papaya. Its habitat is woodland, where it forages in the higher parts of tall trees, often in the company of *Ptilinopus*. They are frequently found in fresh-water marshes, where they perch, apparently to sun themselves, on the fronds of the fern-like plant which grows there. They appear not to feed in this environment, however. At dawn a chorus of hooting is heard, in which all the adult males take part. This song is a low moan, *ooooo*, uttered at intervals of 10 to 20 seconds. It is heard much less frequently during the rest of the day. Pairs are found as a rule, but the females

usually remain concealed in the foliage whereas the males take up conspicuous positions. The mating performance usually takes place on bare, horizontal limbs of tall trees. The female alights on the limb and begins to walk along it toward concealment in the leafy part of the tree. The male then flies to the same branch and utters as he alights a long snarl which can be represented as *crrrrreeeeeek*. He walks rapidly after the female and follows her leaps from one branch to another whereupon she escapes to another tree and the performance may begin again.

Like the Incubator Bird, the tiny solitary Palau Ground Dove (*Gallicolumba canifrons*) inhabits only woodland growing on rocky ridges. It was commonly found in this situation on Peliliu and Koror in the Palau group. This elegant bird forages only on the ground for its food of hard berry pits which are ground up in its stomach. It prefers the few available accumulations of soil and leaf mold on saddles between ridges, on flat rocks or in the bottoms of ravines, although it occasionally walks among the jagged boulders, where, like the Incubator Bird, it proceeds as smoothly as if walking along a paved road. When startled, it leaps from the ground with an audible clap of the wings, flies very swiftly for a short distance, alights and retires behind a tree-trunk for a few minutes, then continues feeding. It walks swiftly and gracefully, here and there picking up seeds from the ground. The head moves back and forth with each step, and the legs twinkle with their rapidity of progression. Each male has a fixed song-perch about ten feet above ground on a horizontal twig screened by vines, where it can be found daily. On Peliliu two adjacent males sang from perches only 30 yards apart. The song is not the moan of *G. xanthonura*, but is a series of seven or eight gentle coo's, each with an upward "questioning" inflection, and very soft. This charming dove fascinated me more than any other Micronesian bird. Its graceful movements, soft plumage colors and the splendor of its brilliant pink feet and eye-ring made each glimpse of it a thrill.

Of the strictly land-dwelling birds the Nicobar Pigeon (*Caloenas nicobarica*) of Palau is the only one for which I do not have series of specimens from each island of occurrence. I saw only two individuals during my stay on Palau from November 1 to December 6, 1945. One was seen in flight over Bloody-nose Ridge, Peliliu; the other was flushed from the ground on the top of the forested ridge on Koror.

In the Palau group of islands the Palau Owl (*Pyrroglaux podargina*) occurs in pairs spaced at 100-yard intervals through the woodland and portions of the mangrove lagoons adjacent to it. I observed 33 pairs on Koror, representing about half the total population there, and four pairs in a patch of natural woodland remaining on Peliliu. Although no defense of territory or trespassing across supposed territorial boundaries was noted, I think that the species is territorial because each pair stays within a limited area all night long (they spend hours in the same group of trees), there are seldom more than two birds in such an area, and the males advertise their presence at a high perch in the center of this area by incessant loud singing during the first few hours of the evening and by sporadic singing through the rest of the night. Most of my observations on this species were conducted at the northwest end of the steep forested ridge on Koror. This portion of the ridge is about 200 feet high and is surrounded by mangrove swamps to the north and west. Each owl territory on the north side comprises a strip about 100 yards wide extending from the summit to a point about 100 yards out into the lagoon. Other territories exist farther out in the mangrove lagoon and are occupied by pairs which appear to be permanently stationed, judging from the fact that some are heard there soon after sunset, long before any owls begin to fly from their roosting trees. Only a few pairs begin to sing this early, but the same ones do it every evening, at the same time and from the same tree, where presumably they have been roosting during the day. The

majority of the birds begin to call as it is getting dark. They frequent the middle and upper parts of the woodland trees and the tall trees in the lagoon. Food consists of large orthopterans and centipedes.

The voice of the Palau Owl does not remotely resemble that of the screech owls and scops owls of North America; it is identical in pitch, quality and delivery (but not tempo) with the note of the Ferruginous Pygmy Owl of Central America. Each note is a sharp whistled *quirt*. Singing involves a duet by the members of the pair and a flight on the part of the male. This apparent mating performance lasts three minutes and is repeated at fifteen minute intervals during the early evening. While the female is perched silently in a tree 25 to 50 yards away, the male begins to call with low mellow notes which rapidly rise in pitch and intensity of the *quirt* call, repeated at two-second intervals, and carried along at the same pitch for about a minute. As the intensity, tempo and "insistence" of these notes is increased, the intervals become irregular and double notes are frequent. At the end of the second minute he changes to double notes, the second part of each being a minor third lower than the first, and at this point the female begins to call. These double notes, representing the climax in intensity of the song, are uttered every second and the series lasts for a half minute or more, at which point the male, without interruption in the song, flies toward the female. From the moment he takes wing the notes are again single and they rapidly subside in pitch and volume, then cease. The female may or may not join in this flight. If she does, both birds go to a new tree. In any event, the male next calls from near the spot at which the last notes of the flight song were heard.

The song of the female is lower in pitch and mellower than the harsh cries of the male and is condensed in time so that while the male is in flight, both songs correspond. I have noted a somewhat similar duet in the Screech Owl of California, but in that species the male is stationary, the female joins him at the conclusion of his "bouncing ball" song, then they both give the series of double trills.

The skull of the Palau Owl bears fundamental resemblances to those of North American species of the genus *Otus*, although it differs in proportions and in several details which might prove to be important in generic classification if enough species of *Otus* were represented by skeletons to permit a thorough comparison of the two genera. Otherwise, the Palau Owl seems very unlike North American *Otus*. It lacks "ear" tufts, has a white bill, light gray cere and whitish feet (pale gray above and cream color below). The iris is brown.

The Jungle Nightjar (*Caprimulgus indicus*) is a common nocturnal bird of the woodlands and adjacent mangrove lagoons on Palau. They are first seen as darkness approaches and forage in the early evening on June beetles, grasshoppers and other large insects. As in other caprimulgids, the first specimens taken at dusk are already crammed with food, recently captured and undigested. One such stomach contained ten beetles, each two centimeters long. They take insects on the wing, either during continuous swift erratic flight about the periphery of the forest trees and the large trees in the mangrove swamp, or by making repeated sallies from a bare twig which commands an unobstructed view for 50 yards or more horizontally within or at the edge of the forest. Such fixed forage perches can be either at the top of a tree, on a dead projecting branch at middle height, or from a stake a foot from the ground. The bird returns to this perch after the capture of each insect, which may take it out 30 yards or more. I have never seen them on the ground.

The legend that *Caprimulgus* and its relatives invariably perch lengthwise on horizontal branches doubtless stems from the fact that when sleeping during the day and

when dozing late at night (while digesting the food that they succeed in procuring during a very short and efficient forage period in the evening), they *do* recline in this manner. Such quiescent birds are difficult to detect by eye reflection because their eyes are closed or open just a trifle. It is my experience with the Jungle Nightjar as well as with the Poor-will, Whippoorwill and Chuck-will's-widow of North America that the birds perch crosswise on small twigs or at the tip of vertical stems while engaged in insect foraging from a fixed perch in vegetation.

Fig. 40. Egg of the Fairy Tern (*Gygis alba*) placed on a thick branch of a breadfruit tree 20 feet above the ground.

The Jungle Nightjar is solitary while foraging, but groups up to a half dozen sometimes engage in community singing at dusk in the tops of some of the largest trees, and two or more may frequently be seen chasing each other through the forest. During November and part of December the birds were erratic in their distribution, covered very extensive areas in foraging, and were not found in the same places on successive evenings. A call, given in flight, especially when birds are chasing each other, is a rasping snore of one syllable. The song uttered by a single perched bird is a long succession of harsh percussive whistles, each with a downward inflection, two or three per second. In group singing this song is mellower and is speeded up into a roll which is uninterrupted for minutes at a time. These hammerings, together with the notes of the Palau Owl and Crimson-crowned Fruit Dove, the incessant snarling and bickering of fruit bats, the "stomach rumblings" uttered by gecko lizards, the rasping of the Common Noddy (in flight along the crest of the ridge all night long) and the piping of tree frogs, make up the pandemonium of nocturnal sounds to be heard on Koror ridge.

The Edible Nest Swiftlet (*Collocalia inexpectata*) is abundant on Saipan, Guam and Palau, but is not continuously present on Tinian. Large flocks of these tiny birds forage during the day over ridges and along the steep sides of canyons where there is little vegetation. They avoid the dense forest. Smaller flocks of about a dozen birds spend all day foraging within a circumscribed area, for instance a bare hillside, a road bank, or the circumference of a large tree standing in the open. They are also found in pairs in similar situations, apparently at any time of year. Pairs and small flocks are found daily

at the same spot. The members of a pair spend hours foraging in a fixed circuit only 25 to 30 yards in diameter and execute the same maneuvers each time around, staying within one to five yards of the ground. During the day they take no part in the activities of large flocks which may be directly overhead. Sometimes they chase each other and utter slight chirps and twitterings. The flight is very slow, consisting of smooth glides interspersed with flutterings to regain altitude. The pitch of the wings is changed constantly during the glide; in another characteristic mannerism the bird rolls sharply at the end of a flutter so that for an instant one wing is pointing up, the other straight down. The food consists of a variety of tiny arthropods, gathered, of course, in flight.

At dusk all the swiftlets from a large area congregate at one place. For instance, at the northeast end of the ridge on Koror the swiftlets begin to gather each evening along a road between the woodland and the mangrove swamp, augmenting the number represented by the local groups and pairs there, until several hundred are present. They all continue foraging close to the ground, even after the sheath-tailed bats (*Emballonura*) are out (the two species operate together in very similar style), then they begin to ascend as they mill around in a loose cloud. By the time it is dark, the cloud of swiftlets has disappeared over the top of the ridge.

An indication either of seasonal cycles of activity or of nomadism on the part of the large flocks of swiftlets is the fact that on Saipan the evening congregations are found only for a few consecutive weeks at any one part of the island. On Tinian there was a flock at Marpo Valley during the first half of October, 1945. By the twentieth, there were only four birds, and from October 22 until at least the middle of November there was not a single swiftlet on the entire island. Geographic variation is exhibited in this species. Twenty-five specimens of the race *bartschi* from Saipan, Tinian and Guam are of uniform dorsal coloration and possess a wing-length average of 107.6 mm., whereas the six examples of the Palau race, *pelewensis,* have a light rump patch, are grayer, less brown ventrally, blacker and glossy above, and average 110.9 mm. in wing-length, all exceeding the average for *bartschi.*

On Guam the Micronesian Kingfisher (*Halcyon cinnamomina*) is abundant in woodlands, although it is rarely seen or heard unless looked for. Almost invariably a pair can be found if one goes to the largest tree in the vicinity and looks among the bare horizontal branches on the underside of the crown canopy which command a view of the ground beneath. The birds will be sitting there perfectly still. They harry unmercifully the flocks of Bridled White-eyes, which set up a confusion chorus at each appearance of a kingfisher. Stomachs contained only small and large insects, a large annelid and fish scales, and I have never witnessed the actual capture of a white-eye. A nest was found in a hole 20 feet up in a tree trunk. On Palau this bird is still more secretive. Most of the few pairs that I saw there were encountered face-to-face as I groped along trails or clambered about the rocks in the woodland trying to retrieve specimens. They do not fly until one attempts to grab them. They perch silently and absolutely motionless on horizontal vine stems a yard or two from the ground. Stomachs contained large cicadas and large grasshoppers swallowed whole.

The White-collared Kingfisher (*Halcyon chloris*) is the most conspicuous bird to be seen and heard on Saipan and Tinian, and it also is abundant on Palau. It prefers the shoreline vegetation for its foraging. Usually it perches on a prominant branch or at the top of a *Casuarina* tree, from which it glides swiftly to the ground to capture its prey of large insects (grasshoppers, beetles, wasps), spiders, crabs, lizards and house mice. Smaller insects are occasionally taken. The prey is swallowed whole, and if it is large, such as a lizard, the tail sticks out of the kingfisher's mouth. I saw one killing a mouse

by whacking the skull repeatedly with its bill. At dusk this kingfisher feeds like a motmot, making rapid flights from a fixed perch to hover and catch insects about the peripheral foliage of low trees.

On Saipan and Tinian the White-collared Kingfisher is an unrelenting assailant of the Bridled White-eye, although I have never seen one make a successful capture. It flies at great speed into a tree, scattering white-eyes like leaves before the wind, then perches and sits very still for a long time, before making another foray. An occupied nest was found in a road bank on Saipan in August. It was a tunnel, three inches in diameter, burrowed out of the earth, which slanted upward slightly and opened into a larger cavity.

White-collared Kingfishers are frequently found sleeping at night on horizontal twigs or vine stems situated on the underside of the crown of the larger woodland trees. This species is found usually in pairs, but often three to five will gather to fly in large circles at a great height, keeping up a veritable din of call notes, then parting to fly in opposite directions high over the canyons and ridges. In fighting, they endeavor to grasp bills and wrest each other from their perch. The loser hangs, shrieking and fluttering,

Table 1

Geographic Variation in the Genus *Halcyon*

	Halcyon cinnamomina		*Halcyon chloris*	
Race	*cinnamomina*	*pelewensis*	*albicilla*	*teraokai*
endemic on	Guam	Palau	Saipan, Tinian	Palau
habitat	woodland (secretive)	woodland (secretive)	beach forest, coastal shrubbery (conspicuous)	beach forest, edge of mangrove swamps (conspicuous)
call notes	crrreeee; haw-hée, haw-hée (usually silent)	clip-a clip-a clip-a; crrreeee, crrreeee, crrreeee (usually silent)	clip-clip-clip, clip-clip-clip; haw-hée, haw-hée, haw-hée (vociferous)	crrreeee; clip-clip, clip-clip, clip-clip (less vociferous)
back color ♂	bluish-green	bluish-green	bluish-green	bluish-green
ventral color ♂	cinnamon	white	white	narrow black tips on white ventral feathers
crown ♂	cinnamon	cinnamon	white	bluish-green
collar ♂	cinnamon	white	white	white
♀ differs from ♂ in:	back dusky olive-green, belly white	back and several streaks on crown, dusky olive-green	back and rarely one or two streaks on crown, dusky olive-green	back and crown dusky olive-green
juvenile differs from adult ♂ in:	cinnamon edges on wing coverts, narrow diffuse black tips on collar and chest, crown heavily streaked with dusky green edged with cinnamon; belly: ♂ light cinnamon, ♀ cream	same	white edges on wing coverts, narrow black tips on white chest feathers, crown heavily streaked with dusky-green edged with buff	same
average measurements				
wing	100 (7 adults)	89 (3 adults)	111 (25 adults)	109 (7 adults)
tail	75	68	80	72
tarsus	16.4	13.7	16.9	15.3
bill (from nostril)	37.5	39.1	46.1	45.7
bill depth	12.6	11.6	14.4	13.7

from the other's bill. A peculiar posturing display seen on Saipan begins with a bird uttering loud calls as it approaches a tree where another is sitting. As it alights, it assumes a rigid posture with the back vertical, the tail up at a 90 degree angle to the back, and the head and neck extended at an equal angle forward. This position is held for several minutes, even after both birds stop calling.

The marked geographic variation exhibited in the genus *Halcyon* from these islands is summarized in table 1. Each of the four forms (two races for each of the two species) uses only two of the three available kinds of call notes and modifies them somewhat in tempo and quality. The juvenal plumage of one race may suggest the adult plumage of another. The two species do not approach each other in wing and bill length. The races of *cinnamomina* show no overlap in wing, tail and tarsus, and the forms of *chloris* do not overlap in the tail dimensions.

In appearance and forage behavior the Cicada Bird (*Edolisoma tenuirostre*) of Palau resembles a solitaire. Family groups are found in November; they are always on the move, not found daily in the same area, and the individuals stay close together, often in the same bush. They forage at the edge of the woodland, catching insects on the wing by straight flights from a high perch, or they eat berries, other vegetable matter and insects as they hop in the small twigs. They are not common; generally only one group is found in a day's search. The call is a soft mellow whistle with upward inflection like the call of the Swainson Thrush. When chasing each other the birds utter a series of these followed by whistles of downward inflection and a twanging quality. The adult plumage in this species is not attained by the postjuvenal molt, at least one additional molt being required to produce the slate blue of the male and the dark head and back of the female.

The song of the Palau Warbler (*Psamathia annae*) is heard continuously during the day from the vine tangles within woodlands on the islets of the Palau group. It resembles the song of the Varied Thrush, that is, each long whistle is uttered at a different pitch and the higher ones are of two simultaneous tones. They lack the vibrant trill of the high notes of the thrush and differ also in that each tone swells gradually then diminishes in volume, thus enhancing its eerie effect. The notes are remarkably full and penetrating in quality, although not loud. From the higher tones the bird may slur upward then give a warbled phrase of five notes (used as a call note by the female) which may be repeated rapidly or in the early morning may be extended into a lengthy song. Ratchety wren-like calls are also uttered. This species is very abundant, but the individuals are spaced separately or in pairs at regular intervals through the woodland. Singing and foraging take place within the concealment of vine tangles, either high in the trees or close to the ground. A male will spend hours in the same vines, alternately singing and foraging. Food of large or small insects and snails is picked from the vines as the bird hops in leisurely fashion through this growth. I have not found them actually on the ground.

The song and call note of the Nightingale Reed Warbler (*Acrocephalus luscinia*), of Saipan and Guam, are identical with those of the California Thrasher, making allowances for the smaller body size and consequent lesser volume of the song in the Marianas bird. The body proportions and bill are also similar to those of the thrasher, as well as the habit of mounting to a tree top to sing in the evening. All the males sing in a chorus at dawn but singing is less frequent during the day. If one bird begins, the others join in. They sing constantly throughout moonlit nights. Midday singing is from concealment in the cane. This species gathers its prey of lizards, snails, spiders and large insects from the ground. Its distribution on Saipan is most peculiar. There is a large dense population in the marsh lands surrounding Lake Susupe, where the birds prefer

dense vegetation, avoiding only the trules growing in the water. It is absent from extensive marshes elsewhere on the island, except for a few pairs at Tanapag Harbor. There are four other small colonies at widely separated points, differing greatly in habitat. One is in tall grass in moist gullies at the top of the mountains in the center of the island, another in dense low forest on rocky ground on the shore of Magicienne Bay, another at the edge of woodland in the central eastern part of the island, and the last, also on the east side, a mile south of the previous, inhabits vegetation along a stream which flows through a wooded canyon. This is the only Saipan bird which is not found uniformly throughout a given kind of environment.

The Rufous-fronted Fantail (*Rhipidura rufifrons*) is abundant in the woodland understory vegetation on Saipan, Tinian and Guam. It feeds on small insects caught on the wing or picked from the surface of tree trunks, branches and foliage. In either case the food is taken while the bird progresses swiftly forward, by zig-zag darting flights or rapid hopping. It does not return to a fixed perch after capturing each insect. Flights are usually in a horizontal plane, and several insects are taken before the bird again alights. Because of the small size of the bird, it can dart rapidly through dense growth with amazing agility. The body is maintained in a horizontal position and the tail is kept spread during this activity. Also the wings are never tightly folded. These birds forage singly and are often hostile to each other. Because of their great numbers they are constantly meeting and do much chasing, calling and singing, all of which suggests a marked territoriality. They indulge in a dawn chorus of singing. The delightful song consists of a descending cascade of thin piping notes, often preceded by the longer high-pitched notes used separately as sequestration calls. Thus the song resembles that of the Golden-crowned Kinglet, but being at somewhat lower pitch, is tinkling in quality rather than squeaky.

A geographic representative of the Rufous-fronted Fantail is found on Palau (*Rhipidura lepida*). Like the former species it is found in the understory vegetation of the woodland habitat and forages in the same way on small insects, but because of its much larger size it appears to lack the nimbleness of *rufifrons*. It occasionally feeds, half flying and half hopping, on rocks and along fallen tree-trunks. Its voice is entirely different from that of *rufifrons*, and I heard no singing from the birds during November and December. The call notes are lower in pitch and consist of loud harsh scolding notes as well as a succession of syllables on the same pitch, each with a downward inflection. A display was noted in this species, which appears to be lacking in the Marianas bird. The tail is fully spread and cocked up over the back while the bird parades in front of his perched companion. In foraging the tail is closed, in contrast to the medium spread at all times maintained by *rufifrons*.

The following remarks on variation in the geographically complementary forms of the genus *Rhipidura* from these islands is based upon my series of 31 specimens of *Rhipidura rufifrons saipanensis* from Saipan (12) and Tinian (19), 15 *Rhipidura rufifrons uraniae* from Guam, and 12 *Rhipidura lepida* from Palau. The wing, tail, tarsus and bill from nostril are longer in males than in females. There is no statistically significant difference in these dimensions among the Saipan, Tinian and Guam populations. Setting the measurements of *rufifrons* at 100 per cent, we find that *lepida* exceeds it by 15 per cent in wing, 14 per cent in tail length, 32 per cent for the tarsus and 35 per cent for the bill length. There is no overlap between the two species in these characters. In coloration the Saipan and Tinian populations are identical. Geographic variation in color is summarized in table 2.

The juvenal plumage of the two species is practically identical, and dorsally it is

intermediate between the two adult plumages. The feathers of the dorsal surface are brown with narrow rufous tips on the body feathers and wide rufous margins on the wing coverts. The major difference is the tail tip, which is white in *rufifrons*, rufous in *lepida*. When the rufous tips wear off of the body feathers and the black throat patch begins to appear (the postjuvenal molt begins on the forehead, chin and throat) juvenal *rufifrons* are indistinguishable in the field from the adults, whereas in *lepida* they are different from the adults and look more like *rufifrons*.

Table 2
Geographic Variation in Adult Plumage of the Genus *Rhipidura*

	saipanensis	*uraniae*	*lepida*
dorsal color	brown; forehead, superciliary and rump rufous	same, but back possibly more olive	rufous
extent of white on chin	wide	very narrow	wide
white-tipped feathers on posterior part of black throat	wide zone	narrow zone	none (all black)
light chest spot	none	buffy white	white
belly and flanks	buffy medially, grading to rufous laterally	buffy medially, grading through cinnamon to olive-brown	concolor, rufous
tip of tail	white	white	rufous

The Tinian Monarch (*Monarcha takatsukasae*), endemic on Tinian, is present in about equal numbers with *Rhipidura* in woodland, but it reaches the peak of its abundance in a kind of arborescent marsh vegetation found in Marpo Valley. *Rhipidura* is absent from this growth. *Monarcha* is a phlegmatic bird compared with the fantail; it moves slowly through the foliage, occasionally flying after insects and hovering at the peripheral foliage of the tree. The food is entirely composed of small insects. The most frequent type of foraging consists of repeated flights from an exposed perch in the understory of the woodland, where the bird sits erect, inspecting the air for passing insects. They occur in pairs, and their harsh wren-like calls are uttered when they chase each other. The song, heard especially in the evening, is remarkable for its clarity and purity of tone. It consists of three notes: two grace notes followed by a beautiful *wheeeooo* of descending inflection.

Age variation in color of bill, but not in plumage, is revealed by the 35 specimens. The bill of the youngest birds, with skulls entirely of one layer, is black on the upper mandible and tip of the lower mandible and yellow on the rest of the lower mandible. A female with a black and yellow bill was photographed by Genelly as it brooded its eggs. None of the specimens with this kind of bill was in breeding condition, however. After a period during which the supposed juvenal plumage may become somewhat abraded, the bill gradually becomes blue, beginning at the base of the upper mandible, at which time the base of the lower mandible is olive. The skull at this stage has "windows." The bill then becomes blue except for a small black line near the tip of the upper mandible. The males (three examples) still have small skull windows at this stage, have reached full breeding condition, and are again in fresh plumage. Later the skull is completed and the bill is entirely blue. Females retain the black tip for a while after the skull is completed; two of three such specimens are in breeding condition, one with a brood patch.

Micronesian Broadbills (*Myiagra oceanica*), found in pairs on Guam and Palau,

relentlessly chase other birds, especially kingfishers, out of their small territories. The song is a series of seven clear whistles, inflected slightly by the Guam birds. Scolding call notes are also uttered. On Guam they are found in woodland, and on Palau they are very abundant both in the woodland and the mangrove lagoons. They sit upright on an exposed perch in the middle or lower parts of trees and dart rapidly after flying insects,

Table 3
Geographic Variation in *Myiagra oceanica*

	freycineti		*erythrops*	
	male	female	male	female
Dorsal coloration				
forehead	concolor with head	concolor with head	orange	orange
head and neck	dark shiny steel-blue	dark dull blue, not shiny	light blue-gray, not shiny	light dull blue-gray, not shiny
back, wings and tail	blue	dark brownish-gray, orange edges on coverts and inner secondaries	brownish-gray, a few brown edges on wing coverts and inner secondaries	brownish-gray, brown edges on wing coverts and inner secondaries
Ventral coloration				
extent of white	chin, under tail coverts and most of underparts usually white	median posterior region	half or none of underparts; under tail coverts usually orange	median posterior region more salmon
tone of orange	yellower, more golden		pinker, more salmon	

returning to the same perch and quivering the tail after each capture. They also take insects from the foliage as they hop among the higher twigs. This species is a powerful flyer, seen to advantage as it streaks over the water from one mangrove to another. The male is larger than the female, and the two races (*freycineti* of Guam, 10 specimens; *erythrops* of Palau, 8 specimens) differ greatly in tail length, width of bill and coloration. They do not overlap or approach each other in these characters. Average measurements of six Guam and five Palau adult males are, respectively, wing 70, 69; tail 59, 53; tarsus 19.9, 20.1; bill from nostril 8.7, 8.9; bill width at nostril 6.5, 7.3 mm. The extra width of the bill in the Palau race is made up lateral to the nostril, so that the nostrils of the two forms are the same distance apart. There is great individual variation among the males in the extent of the orange areas and in the amount of white tips to the orange feathers. The females lack the white tips and do not vary. Table 3 summarizes the outstanding points of dissimilarity in color between the two races, from which it can be seen that there is a more noticeable sexual dimorphism in *freycineti* than in *erythrops*.

The Morning Bird (*Colluricincla tenebrosa*) inhabits the dark woodlands of Palau, where it forages at middle tree height on insects, berries, fruit and snails by hopping through the branches and vines in the manner of a jay. It is common but not evenly dispersed. Groups of two to eight individuals roam through the woods, each bird staying within hearing distance of its companions. In behavior they resemble the Gray Jay; that is, they have no fixed postures or stereotyped forage method, rather they peer about, apparently keeping track of everything that goes on, and are ready to utilize any food source. They are inquisitive to an astounding degree. They used to gather around me to sit quietly and stare from a distance of only two or three feet with their bills wide open. They have a great variety of conversational notes and a wide vocal range difficult to characterize except for quality, which is decidedly "tinny." The song has the quality and structure of the Black-headed Grosbeak's song, but is more rushed and of shorter

duration. An impressive pre-dawn chorus is a further unforgettable attribute of this remarkable species.

The Micronesian Starling (*Aplonis opacus*) frequents the woodlands of Saipan, Tinian and Palau in roaming flocks of a dozen to fifty birds, but on Guam they drift through the timber in great loosely organized hordes. Sometimes the juveniles are found in flocks by themselves. Food consists mostly of fruit, but seeds and insects are also eaten. Foraging takes place at varying heights in the trees. They congregate in bare branches of trees and are particularly numerous around cliffs, where, on Saipan, they nest in potholes in the rock. Long flights, high overhead, are frequent. The song consists of gurgling and bubbling notes with whistles interspersed. There are many conversational variations in the loud calls. The measurements of 33 specimens of the race *guami* from Saipan, Tinian and Guam agree with the findings of Baker (*op. cit.*: 70) that the Saipan and Tinian birds have a slightly longer wing and deeper bill than those from Guam. I have only six specimens of the race *orii* from Palau, but their bills are decidedly less deep than *guami*, with no overlap. In coloration, the two races are identical. In adult plumage, the feathers of the male have larger glossy areas than do those of the females. There is considerable individual variation in the juvenal plumage, the ventral ground color of which varies from white to dark brown.

The Guam Crow (*Corvus kubaryi*) inhabits, under natural conditions at least, the deepest forests on Guam. Foraging takes place on the ground beneath the dense woodland canopy, where the birds are secretive and noiseless. Stomachs of five specimens contained grasshoppers and other insects, lizards, buds, flowers and other vegetable matter. Crows are found in two's or small groups but the individuals do not forage close together. Their "caw" has conversational variations.

The beautiful Golden Honey-eater (*Cleptornis marchei*) is numerous in the understory of the Saipan woodlands; it is the only species on that island which cannot be found in the Lake Susupe marshes. Its large eye appears to be an adaptation for life in the shade. In spite of its long legs, and thrush-like build, it does not feed on the ground. It eats mostly berries with hard pits, which are swallowed whole; it also takes seeds, insects and spiders, the latter being captured as it flits rapidly from twig to twig. When perched, it stands high, with the body nearly horizontal and flicks the wings like a Hermit Thrush. Although not strictly a flocking species, there are usually three or four birds in the same group of trees, and they chase each other, uttering strident wren-like notes during their swift flight. They also have a twanging call similar to that of the Varied Thrush. I have frequently seen congregations of ten or a dozen birds, all clamoring loudly, and have never been able to find a reason for the commotion. The food call of the juvenile is a plaintive mellow whistle. This species appears not to sing at all.

The Cardinal Honey-eater (*Myzomela cardinalis*) is common in woodland on all the islands visited. I have little to add to Mayr's account (Birds of the Southwest Pacific, 1945:100-102) of this bird except that the male appears to be strongly aggressive, chasing other species, especially white-eyes, away from his flowering trees. Pairs seem to have a fixed foraging circuit which includes widely separated, selected trees, and around which the male is preceded by the female. Snails are sometimes eaten. The "song" is just a loud wheezy whistle. The two races (*saffordi*, 18 specimens from the Marianas; *kobayashii*, 8 specimens from Palau) differ in the hue of red color (shown in juveniles and adults of both sexes). *Saffordi* is orange-red whereas *kobayashii* is a deep pure scarlet. The ground color of the adult female is, respectively, olive-brown and dusky-brown. The calls of *kobayashii* are lower in pitch than those of *saffordi* and are easily confused with notes uttered by *Aplonis*.

The Bridled White-eye (*Zosterops conspicillata*) is a non-territorial species which is found in flocks of a dozen to 50 individuals at all months of the year, even when some pairs are nesting. They feed among the small twigs in all kinds of habitat, showing a marked preference for trees and bushes which have small leaves or leaflets. Each flock makes the rounds of a fixed forage circuit. On Palau, one such circuit included the edge

Table 4

Number of Specimens Exhibiting Certain Colors of Soft Parts in *Zosterops conspicillata*

	Iris			Base of Lower Mandible		Upper Mandible		Feet	
Population	brown	light gray	white	gray	yellow	blackish	olive	bluish-gray	olive
Saipan									
ad (11)	10	1		11		11		11	
im (15)	9	6		15		15		15	
Tinian									
ad (21)	21			21		21		21	
im (21)	21			13		21		21	
Guam									
ad (6)	2	4			6		6		6
im (7)	1	6			7		7		7
Palau									
ad (7)			7	7		7		7	
im (5)			5	5		5		5	

of the woodland, bushes in gardens, and taller trees in an adjacent mangrove swamp. The flock made the rounds here about once every hour, but at one time the birds interrupted their foraging to rest silently for a half hour in a large tree in the swamp. A neighboring flock of Gray-brown White-eyes had about the same circuit, but the two species remained independent, their paths crossing occasionally as if by accident, at which times they would both forage in the same tree at the same time. The principal food is berries (with hard pits 4.5 mm. in diameter) swallowed whole. Seeds, fruit, caterpillars, ants and other small insects are taken; grasshopper parts and small snails are found in their stomachs rarely. Insects are taken as the birds move rapidly through the foliage, occasionally making short flights into the air or hovering in front of a leaf spray. A common attitude in foraging is a horizontal position of the body, with bill, body and tail in line, like a nuthatch. They flick the wings constantly.

Their high-pitched location notes are constantly uttered, apparently serving to keep members of the flock together, and are intensified by the stragglers. When flying across open spaces from one forage tree to the next, they stay within three to six feet of the ground. On only one occasion did I notice a bird actually singing. It was an adult male collected on Tinian, whose song had been merely an extended series of the usual siskin-like call notes. The "confusion chorus," invariably heard upon the dramatic arrival of a kingfisher, consists of the ordinary call notes delivered at maximum intensity and frequency by all members of the flock. It lasts for a minute or so, during which time the birds remain stationary. They respond in this manner only to the kingfisher in flight. After he has alighted the confusion chorus dies down and they resume foraging, only to be thrown again into consternation at the next attack of the kingfisher, who may have been sitting in the same tree with them all this time.

Measurements of the 95 specimens from Saipan (27), Tinian (43), Guam (13) and Palau (12) reveal that the adults are slightly larger than the immatures, but that the two sexes are practically identical and that the Tinian population is indistinguishable from the one on Saipan. Slight differences in average measurements of adults among the three races (*saipanensis* of Saipan and Tinian, *conspicillata* of Guam, *semperi* of Palau)

range from 2 to 5 per cent in magnitude, with *conspicillata* possessing the longest tarsus and largest bill, and *semperi* possessing the longest wing. Striking differences in coloration are found, however, as summarized on tables 4 and 5. The Saipan and Tinian populations differ somewhat in color of iris and bill. There are marked differences in voice among the three races. *Saipanensis* utters high-pitched plaintive siskin-like calls and a rough *chilp chilp* like an English Sparrow. The high-pitched calls are absent from the repertoire of *conspicillata*. The notes of *semperi* are high clear whistles: *tee dee, tee dee, tee dee-dee-dee*.

The Bridled White-eye is the only species in which blood parasites were found. Those on Saipan and Tinian were almost universally infected with *Haemoproteus* and had microfilariae in an incidence of about 15 per cent. Neither parasite was found in the Guam white-eyes.

Table 5

Geographic Variation in Plumage Color of *Zosterops conspicillata*

	saipanensis	*conspicillata*	*semperi*
back	dull green	dull green, rump yellowish, crown feathers gray basally	bright yellow-green
lores	cream (narrow)	white, yellowish in 3 (wide)	yellow (medium width)
white eye-ring	medium	large	small
black border below eye-ring	conspicuous	small	inconspicuous
auriculars	same color as back	gray (greenish in 3)	same color as back
chin and throat	same color or slightly lighter than belly	whitish, in contrast to rest of underparts (yellow in 2)	yellow, same as rest of underparts or brighter
rest of underparts	dull yellow; yellowest posteriorly	pale pure yellow; yellowest posteriorly	intense yellow; yellowest anteriorly

The Gray-brown White-eye (*Zosterops cinerea*) of Palau is much more abundant in deep woodland than is the Bridled White-eye. It differs further in that pairs are found as frequently as flocks, foraging takes place in the crown foliage of the larger trees, and the flight is powerful; individuals and small groups are often seen on long flights, high in the air. Like its relative, it frequents all kinds of vegetation in addition to woodland. The food of this bird consists mainly of berries and fruit, although insects are occasionally taken. Its call notes are not as sweet and clear as those of *semperi* but are of the same pattern.

In appearance, habits and voice the Large Palau White-eye (*Rukia palauensis*) does not even suggest, let alone resemble, the other species of white-eyes on these islands. It does not travel in flocks, and a male will chase starlings and kingfishers away from the tree in which he happens to be singing. Individuals chase each other from time to time, uttering loud grating calls. When one male begins to sing, others in the vicinity do likewise and a chorus ensues. After a time they suddenly stop and streak away into the vine tangles, bursting into song again one-quarter to a half hour later from a different group of trees. This species prefers the upper parts of tall, vine-draped trees, where it sings either from concealment in the vines or from bare branches, and forages on caterpillars, ants and fruit. They feed also in vine tangles close to the ground. The remarkable song consists of high-pitched loud whistles and trills. Several opening whistles have a marked downward inflection and a strained quality as if uttered in extreme agony. These are followed by a long trill which surges in intensity, and there are whistles of upward inflection uttered polyphonically while the trills continue as a background. The

song therefore sounds somewhat like two canaries singing at the same time. A further peculiarity in this species is that it is abundant on Peliliu and absent from similar environment on the neighboring islands of the Palau group.

BREEDING AND MOLTING SEASONS

It is perhaps not too early to advance some tentative inferences concerning the presence or absence of an annual cycle of breeding activity in the endemic species. Combining my information on breeding with that presented by Baker (*op. cit.*: 35-74) we find that 13 species, for which sufficient specimens and records are available, appear to breed the year around. Not every month is represented for any one species, nor is there enough information to determine if nesting is more frequent in some months than others; however, in these species series of specimens from any time of year show that all the adult males (with exceptions noted below) have testes of maximum size, and in passerines the accompanying enlargement of cloacal tubules is noted. Some of the adult females are laying, others may have a brood patch. The few records of nests and downy young for these species are from widely separated months. It is of particular interest that in those marked with an asterisk (to which *Cleptornis marchei* must be added) some immature individuals (in partial or complete adult plumage) are in full breeding condition before their skulls are fully matured. In passerines, this means that they breed when they are only about six months old. The species assumed to breed all year are the following: *Ixobrychus sinensis, Anas oustaleti, Rallus owstoni, Gallinula chloropus, *Ptilinopus porphyraceus* (including the Marianas form), **Gallicolumba xanthonura, Halcyon chloris, *Acrocephalus luscinia, *Rhipidura rufifrons, *Monarcha takatsukasae, *Aplonis opacus, *Myzomela cardinalis* and **Zosterops conspicillata*. In the following species some adult males are not in breeding condition in the same months when others of the same island population do breed: *Halcyon chloris, Psamathia annae, Myiagra oceanica* on Guam, *Aplonis opacus,* and *Zosterops conspicillata* on Palau.

Other species, represented by fewer specimens, at least definitely breed in the months noted: *Demigretta sacra* in April on Tinian; *Nycticorax caledonicus* in August, September and December; *Rallus philippensis* in September and November; *Porphyrio porphyrio* in September; *Gallicolumba canifrons* in November and December; *Collocalia inexpectata* on Guam in February and May; *Halcyon cinnamomina* on Guam in March to July; *Psamathia annae* in November and December; *Myiagra oceanica* in May and June on Guam, and November on Palau; *Cleptornis marchei* in January, February and April; and *Rukia palauensis* in November and December.

Scanty evidence of a seasonal cycle is provided by species in which none of the individuals (number of specimens indicated in parentheses) are in breeding condition at a certain time of year. *Pyrroglaux podargina* (4) and *Caprimulgus indicus* (5) are not breeding in November and the first week of December, although they have slightly enlarged gonads and sing in these months. *Edolisoma tenuirostre* (8), *Rhipidura lepida* (12), *Colluricincla tenebrosa* (11) and *Zosterops cinerea* (7) appear not to breed in November. *Corvus kubaryi* (5, in addition to others listed by Baker) does not breed in May, June and July.

In only three species are the individuals taken in a given month all at the same stage of molt. *Pyrroglaux podargina* (4) are in worn plumage in November. Four specimens of *Acrocephalus luscinia* are in new plumage in February, one is worn in June, and seven, one of which is beginning to molt, are in extremely abraded plumage in September. All five specimens of *Corvus kubaryi* taken in May and June are in the middle of a complete molt. These species are in marked contrast to the remaining forms, most of which show no correspondence among individuals in the molt program, few individ-

uals being either in entirely fresh or entirely abraded plumage and most showing a mixture of old and new feathers at any time of year. Even the postjuvenal molt appears to be a leisurely affair spread over several months, except in *Aplonis opacus*. In this species the juvenal plumage is carried for a considerable period until it is uniformly abraded and the skull has small windows. Then the entire plumage is replaced by the glossy black adult feathers before the completion of the double skull roof.

COMMENTS ON DISTRIBUTION AND ECOLOGY

Certain conspicuous points of difference between island populations of the geographically variable species have been mentioned in order to emphasize the grossness of the differences and lack of overlap in many characters between these isolated populations as contrasted with the situation among continental polytypic species. Under these circumstances the difficulty of determining which populations are species and which are races is at once apparent. Ecologic criteria are much less useful for island forms than for those on continents because on islands the niches in the environment are not all filled and in the absence of marked interspecific competition the land birds generally show great versatility in utilizing different habitats, as discussed below. There is only one clear-cut case, in the avifauna of the islands which I studied, of geographically complementary forms which could, if necessary, safely be determined as different species on the basis of ecology. This involves the restriction to one or the other of two markedly different kinds of habitat by forms of the genus *Halcyon* on islands where both habitats occur. On Saipan and Tinian, *Halcyon chloris* is found along the shore-line (*Casuarina* trees and coastal shrubbery) and avoids the interior of continuous woodlands. On Guam, *Halcyon cinnamomina* is absent from the shore habitats and is restricted to dense woodland. Therefore each species, where it occurs alone on an island, fills out only its appropriate habitat, in the same manner as when both occur together, as on Palau.

Incipient race formation seems to be taking place in *Zosterops conspicillata* on Saipan, where the population differs in proportion of bill color and iris color types from the population on Tinian, only three miles removed. Otherwise, there is no racial difference to be found between large series of doves, kingfishers, flycatchers and starlings on the two islands. There is a marked difference in composition of their avifaunas, however, which points to the effectiveness of an ocean barrier for some species at least. *Monarcha takatsukasae* of Tinian is not found on Saipan, nor are *Cleptornis marchei* and *Acrocephalus luscinia* of Saipan found on Tinian, although suitable environments for these species are available on both islands.

Four species exhibit a strange sort of discontinuous distribution within the limits of a single island (or group of closely adjoining islets, as on Palau). *Megapodius lapérouse* and *Gallicolumba canifrons* of Palau appear to be restricted to woodland on steep rocky ridges on the outlying islets and are absent from forests growing on deep soil on the large island of Babelthuap. Discontinuities in distribution of *Rukia palauensis* and *Acrocephalus luscinia* are not correlated with differences in habitat. *Rukia* on Palau was found only at Peliliu, and was absent at Arakabesan, Koror and Babelthuap. *Acrocephalus* on Saipan was abundant in the marshes around Lake Susupe, absent from other similar marshes and present elsewhere only in five small colonies in different kinds of environment.

Owing to the vagaries of colonization of these remote islands, their endemic land avifauna is impoverished both as to number of species and ecologic types. As a result, there are many niches for which no species are exclusively adapted. (For instance, there are no birds which forage by picking insects from crevices in the bark, like creepers and woodpeckers, and no birds which crack seeds in their bills.) Correlated with this is a

marked versatility on the part of the passerine species in kind of food eaten and the habitat and substrate on which it is obtained. The swiftlets, nightjars and small flycatchers are the only strictly insectivorous birds found. The doves are strictly frugivorous; the owl, kingfishers, Palau Warbler and Nightingale Reed Warbler are carnivorous (or take larger invertebrates). The rest of the species, most of them possessing bills which one thinks of as "insect-eating," take invertebrate and vegetable food indiscriminately, and in a variety of habitats.

MIGRANTS AND INTRODUCED SPECIES

Brief mention may be made of wintering, migrant or introduced land and fresh-water forms which were found, inasmuch as some records are new for Micronesia. The Egret (*Egretta intermedia*) is a winter visitant to all these islands and is absent only from April to the first part of August. (A lone individual was seen on Guam, June 1.) It is found in flocks of a dozen to 100 birds which forage exclusively in fresh-water marshes and moist grassland, eating house mice, grasshoppers and dragonfly nymphs. They often feed under and around cattle. Specimens were taken on Saipan and Tinian. A migrant flock of six Black-crowned Night Herons (*Nycticorax nycticorax*) was flushed on April 4 at Lake Hagoi, Tinian, where the birds were concealed and sleeping in tall vegetation at noon. One was collected. A wintering Black-crowned Night Heron was seen on several evenings in November on Palau and was collected. A pair of Garganey (*Anas querquedula*) was seen daily in April on Lake Hagoi, and one was collected. They fed as they swam at the edge of the marsh vegetation and flew when alarmed. A flock of 15 Pintails (*Anas acuta*) was seen at Lake Susupe, Saipan, on February 7. A pair of Shovellers (*Anas clypeata*) was collected on Lake Hagoi on October 12. Two Scaups (*Aythya fuligula*) were seen daily at Lake Hagoi in April.

Three kinds of hawks are winter residents on Palau and were seen almost daily in November: a large *Accipiter* the size of a Goshawk, a small *Accipiter* and a medium-sized *Buteo*. Domestic Fowl (*Gallus gallus*) were seen on all the islands, but I was impressed by the wildness of those on Koror, in the Palau group. A small chick in juvenal plumage was collected there in deep natural woodland, far from human habitation.

Two migrating Least Terns (*Sterna albifrons*) were diving for gambusia fish in Lake Susupe, Saipan, on September 26. One was collected. One Domestic Pigeon (*Columba livia*) was seen in natural forest on Tinian in April. The introduced Turtle Dove (*Streptopelia bitorquata*) is an abundant resident which breeds on Saipan, Tinian, and Guam. Specimens were taken on all three islands. It forages only in clearings, roads and farm lands and therefore does not compete nor come into close contact with the native doves, which stay in the natural forest vegetation. A flock of 15 large Cockatoos (*Cacatua*), probably introduced, was seen in November at each visit to a small inland body of salt water in the middle of the steep, heavily forested hills on Koror in the Palaus. Single wintering Cuckoos (*Cuculus*) were seen several times in November on Palau.

Lone migrating adult Barn Swallows (*Hirundo rustica*) were seen by Genelly in March and by myself in April on Tinian. Only immature birds were found to spend the winter on Saipan, Tinian and Palau. Seventeen specimens taken on these islands from October to February are in predominantly juvenal plumage and with skull "windows" indicating immaturity. Apparently it takes all winter for these birds to acquire the adult plumage and at least until December for them to form a two-layered skull. These wintering immatures foraged around Lake Susupe at Saipan where they were accompanied by an unidentified species of swallow. On Tinian they foraged along the edge of a cliff and along the lanes of acacia trees planted in farming country. On Palau, they were found in open farm land.

Two wintering adult Gray-spotted Flycatchers (*Muscicapa griseisticta*; identified by Herbert Friedmann) were taken on Palau on November 6 and December 2, respectively.

Weaver-finches (*Lonchura punctulata* nearest *cabanisi*; identified by Friedmann) were found in grassland on a farm on Babelthuap in the Palaus. Twelve specimens were collected from the flock of fifty at this spot. Adults (determined by skull) were in breeding condition; one female was laying and had a brood patch. The immatures had small gonads and were in various stages of the postjuvenal molt, except one, which had full adult plumage. This species has evidently been introduced recently on the island; they are successfully reproducing there and they occupy a habitat not shared with any native bird.

Museum of Vertebrate Zoology, Berkeley, California, July 19, 1948.

A STUDY OF SEX RATIOS OF MALLARDS IN THE STATE OF WASHINGTON

By CHARLES F. YOCOM

Many data have been recorded on the sex of waterfowl; these have been obtained from duck-banding stations, from hunters' kills by means of questionnaires and personal examinations of the bags of hunters, and by direct counts of migrating and wintering populations. But the questions raised by the several types of available data are such that the subject of sex ratios in waterfowl warrants continued study by all methods available.

The writer became interested in the sex ratio of Mallards (*Anas platyrhynchos*) in Washington when the first returns from questionnaires sent to duck hunters were examined at the end of the 1943 duck-hunting season. The collecting of data on sex ratios was incidental to other work and restricted to the Mallard because sexes in it are easily recognized and it is the most important game duck in the state as a whole. From 1943

Fig. 41. Map of state of Washington showing localities mentioned in text and the three regions established arbitrarily for the study of sex ratios in Mallards.

until 1948 records of sex were reported for 4,564 Mallards shot in Washington. In the fall and winter of 1947-48, the writer additionally investigated by direct count the sex ratio of migrating and wintering waterfowl in eastern Washington. Data on the sex ratio among 8805 Mallards were thus obtained. One purpose of this study is to see if data on sex ratios collected from duck-hunter questionnaires are in accord with data collected by direct count in the field. The investigation was supported in part by the State College of Washington Research Fund.

RESULTS FROM DUCK HUNTERS' REPORTS

The state of Washington was divided into three main regions for purposes of this investigation (fig. 41). Region one includes all the counties on the west side of the crest of the Cascade Mountains. Region two is more or less an arbitrary area including

all the counties in the central part of the state, and region three includes counties on the east side.

Table 1 shows the data on sex ratios in Mallards in the three respective regions. Ratios vary considerably from year to year and from region to region, and the males are for the most part shot more often than females. This is especially true for the eastern counties where the bulk of the data was obtained and where Mallards are the principal waterfowl hunted. Data on sex ratio were obtained both from daily hunting returns and seasonal hunting returns, and both are included in table 1. Frequently, hunters would not turn in daily hunting returns, but would send in a record for the season. On the other hand, some parties would send in the daily return and not a seasonal return, so that there is some, but not necessarily complete, duplication of data collected from the two sources. The ratios collected in this manner vary considerably, but that is undoubtedly due to the small size of the samples in some instances.

WATERFOWL WINTERING IN EASTERN WASHINGTON

In eastern Washington, where the winters are normally mild, the Mallard is by far the most common wintering duck. Large numbers of them feed on waste grain in the fields of the Palouse and Big Bend areas. Large bodies of water, such as Sprague Lake, Rock Lake, the Columbia, Snake and Spokane rivers, as well as small tributaries of these rivers, normally do not freeze over. Such bodies of water are utilized as loitering, resting and roosting areas. From these open waters ducks fly to adjacent feeding grounds. In addition to wheat fields, pea fields are important feeding areas in the Palouse region, where the commercial production of dry peas has become important.

Baldpates also winter in some sections of eastern Washington. A few remain along the Clearwater and Snake rivers in the vicinity of Clarkston, Washington, and feed principally on green grass along the Snake River. Occasionally a few individuals are noted with flocks of Mallards throughout other sections of eastern Washington.

A few American Golden-eyes winter along the Snake River and on Turnbull National Wildlife Refuge. Buffle-heads, Pintails, Scaups, Hooded Mergansers, and American Mergansers also winter regularly in eastern Washington, but their numbers are too limited to yield adequate data on sex ratio. Occasionally Red-heads, Ring-necked Ducks and Canvasbacks are also seen here during the winter months.

RESULTS BASED UPON DIRECT COUNTS

Method of making counts.—In 1947, counts were started on November 20 and continued throughout the winter and spring until March 14. The waterfowl hunting season for the state of Washington was split into two parts, one from October 21 to November 3 and the other from December 16 to December 29. The break in the hunting season made it possible for the writer to obtain data on sex ratio of waterfowl (especially Mallards) during the period between the two seasons when the waterfowl were undisturbed and congregated in large groups. Locally, many waterfowl remained in creeks and fed in adjacent wheat fields in the time intervening between the two seasons. Many were also concentrated along the Snake and Clearwater rivers during the hunting season. The Snake River is a refuge from the east boundary of the state to its confluence with the Columbia River.

Most of the data (table 2) were obtained by walking along the streams where large concentrations of waterfowl occurred, and in some instances large numbers of ducks could be sexed from an automobile driven near concentrations. Along the Snake River, data were obtained by drifting down current in a rubber life raft. In this manner the

segment of the Snake River between Wawawai and Central Ferry, Washington, was surveyed several times.

The most successful method for making counts was to use a pair of 7×50 binoculars and to count segments of flying flocks or of flocks on the ground by groups of three to five. The data were recorded in two columns by an assistant. In this manner it is possible to sex as many as 1000 ducks from large concentrations in a half hour. Mrs. Iris Yocom or a student from the State College of Washington usually accompanied the writer to record the data as they were gathered.

Table 1

Sex Ratios of Mallards Obtained from Duck-hunters' Reports

	Males	Females	Ratio
Region one			
1943 Total	145	133	109:100
1944 Daily reports	13	7	186:100
Seasonal reports	68	50	136:100
Total	81	57	142:100
1946 Daily reports	60	42	143:100
Seasonal reports	184	105	175:100
Total	244	147	166:100
1947 Daily reports	67	49	137:100
Seasonal reports	8	8	100:100
Total	75	57	132:100
Total, region one	545	394	138:100
Region two			
1943 Total	149	84	177:100
1944 Daily reports	105	89	118:100
Seasonal reports	9	6	150:100
Total	114	95	120:100
1946 Daily reports	8	11	73:100
Seasonal reports	22	34	65:100
Total	30	45	67:100
1947 Daily reports	10	3	333:100
Seasonal reports	9	6	150:100
Total	19	9	211:100
Total, region two	312	233	134:100
Region three			
1943 Total	786	549	143:100
1944 Daily reports	143	142	101:100
Seasonal reports	80	83	96:100
Total	223	225	99:100
1946 Daily reports	384	221	174:100
Seasonal reports	189	116	163:100
Total	573	337	170:100
1947 Daily reports	229	127	180:100
Seasonal reports	18	13	138:100
Total	247	140	176:100
Total, region three	1828	1251	146:100

Areas studied.—Figure 41 shows the areas where data on sex ratios were collected throughout the study. The Turnbull National Wildlife Refuge at Cheney, Washington, was visited on several occasions as also were areas in the vicinity of Walla Walla. For the most part, however, the data were collected in areas not far from Pullman, Whitman County. Two trips were made along the Columbia River, and that information is included also in table 2 although that region is somewhat peripheral to the major areas studied.

The winter of 1947-48 was not severe and many ducks remained along the creeks in Whitman County. A flock of approximately 10,000 Mallards remained throughout most of the winter in the vicinity of Colton, Washington. These ducks fed in grain fields in that area. Many Mallards as well as a few Baldpates and a scattering of other species wintered along the Snake River, particularly in the vicinity of Clarkston, Davis Bar three miles below Wawawai, and along the river between Almota and Central Ferry.

DISCUSSION

The writer obtained data on the sex of 4,563 Mallards from questionnaires sent to hunters. Many more males were shot than females. The ratios, however, do not agree with the ratio obtained by Munro (Canadian Jour. Res., 21, 1943:223-260) from data collected at banding stations in British Columbia. His ratio was 84 males to 100 females. Munro also indicates that more females were shot than males.

In this study there were only two questionnaires which reported more hunter-shot females than males. In both instances the samples were small. In 1946, both daily and seasonal records showed more females shot in region two. The seasonal records of 1944 for eastern Washington also showed more females shot than males although the difference is small and possibly insignificant (see table 1).

Sex ratios of hunter-shot Mallards over a period of four hunting seasons, summarized in table 1, show a considerable variation. Some of this variation is undoubtedly due to insufficiency of the data. The summarized data for the four hunting seasons are as follows:

Year	Males	Females	Sex Ratio
1943	1080	760	141:100
1944	418	377	111:100
1946	847	529	160:100
1947	341	206	165:100
Total	2686	1878	143:100

For the most part, the sex ratio of 8,805 Mallards observed during this study in eastern Washington was quite even (109:100); there appears to be, however, considerable variation in sex ratios between duck populations or between flocks in different localities. For example, the Mallards that were observed at the Turnbull National Wildlife Refuge consistently had a high percentage of males, whereas a large flock that wintered near Colton, Washington, had a ratio closely approaching 100:100. All but one of the counts made along the Snake River in the vicinity of Clarkston showed considerably more males than females, whereas counts made on the river between Wawawai and Central Ferry on January 28 showed a nearly balanced sex ratio. On December 7, 1947, the author sexed 251 Mallards out of a large flock that was staying along Missouri Flat Creek which is located only a few miles northeast of Pullman, Washington. This particular flock consisted of many more females than males as shown in table 2. During the same month, however, most of the flocks contained many more males than females.

Table 2 suggests an increase in males in the months of November and December

Table 2

Sex Ratio of Mallards Obtained by Direct Count

	Males	Females	Ratio
Nov. 20, Turnbull Wildlife Refuge	158	136	116:100
Nov. 21, Wawawai to Almota	6	5	120:100
Nov. 28, Turnbull Wildlife Refuge	137	114	118:100
Nov. 29, Missouri Flat Cr. n. of Pullman	76	59	129:100
Nov. 30, Colton	342	338	101:100
Totals for November	719	652	110:100
Dec. 6, Colton	72	67	107:100
Dec. 6, Snake River at Clarkston	212	156	136:100
Dec. 7, Missouri Flat	108	143	76:100
Dec. 8, Turnbull	212	169	125:100
Dec. 16, Columbia River	29	19	153:100
Dec. 19-29, Pullman	14	8	175:100
Dec. 23, Turnbull	176	89	198:100
Totals for December	823	651	126:100
Jan. 11, Clarkston	76	55	138:100
Jan. 15, Colton	712	698	102:100
Jan. 23, Moscow area	192	147	131:100
Jan. 23, Colton	250	248	101:100
Jan. 24, Palouse area	48	48	100:100
Jan. 28, Wawawai to Central Ferry	727	673	108:100
Jan. 30, Walla Walla	235	207	114:100
Totals for January	2240	2076	108:100
Feb. 16, Walla Walla	376	404	93:100
Feb. 16, Columbia River	15	10	150:100
Feb. 18, Walla Walla	56	53	106:100
Feb. 23, Clarkston	100	114	88:100
Totals for February	547	581	94:100
March 13, Snake River	228	235	97:100
March 14, Pullman	30	23	130:100
Totals for March	258	258	100:100
Grand totals	4587	4218	109:100

and then a drop in males until the sex ratio is slightly in favor of the females or is balanced. It is difficult to account for the changes in sex ratios from month to month and from area to area. Hunters definitely shot more males than females in this region, and this may account in part for the decrease in the number of males in February and March. Possibly groups of ducks raised in the same locality migrate and move from one locality to another as a unit, and variation in sex ratio may thus show in part the local influences on the breeding population. Another point of view that should be investigated is the possibility of differential migration or differential ranges of the sexes. Many of the ducks sexed in February and March were undoubtedly birds that had wintered farther south.

Petrides (Auk, 61, 1944:564-571) suggests that male ducks appear to enter banding traps more frequently than females. According to the same author, records of banded ducks before and after hunting, when compared, revealed similar sex ratios, indicating negligible sex selection by sportsmen. In Illinois, Hawkins, *et al.* (Illinois Nat. Hist.

Surv., Biol. Notes, 12, 1939:1-16) found that the take of female Mallards increased through the season from 48 per cent in the first half-month to 62 per cent in the last.

Sex-ratio data obtained in the fall of 1947 from hunters' reports from eastern Washington do not coincide with data obtained by counting sexes in the field. According to hunters' records, the ratio was 176 males to 100 females, whereas according to figures from direct counts, the ratio was 110:100 for November and 126:100 for December, or 118:100 for the two months. It appears to me that the sex ratios obtained from hunters' kills are not representative for the populations of waterfowl hunted and that selective shooting among duck hunters accounts for the larger number of males recorded in returns from hunters.

Considerable study through the entire wintering area is needed to obtain a true picture of the actual sex ratios of waterfowl. There is little or no agreement among data obtained by records of banded birds, checks on kills of duck-hunters, returns of questionnaires, and direct counts. The most reliable data are obtained apparently by counts of birds in the field. The author's results seem to indicate that such counts should be made at several locations within a region to secure a better indication of the sex ratios of waterfowl in that area.

Department of Zoology, State College of Washington, Pullman, Washington, December 14, 1948.

FROM FIELD AND STUDY

Characteristics of the Gyrfalcons from the Bering Sea Area.—Todd and Friedmann (Wilson Bull., 59, 1947:139-150) appear to have settled finally the status and nomenclature of the Gyrfalcons of northeastern North America: they are all *Falco rusticolus obsoletus*. This race is said to inhabit all of arctic North America except the "Bering Sea coast of Alaska," where *F. r. uralensis* is said to be resident.

Uralensis is said to differ "from *obsoletus* only in having the seventh primary (fourth from the outside) longer than the tenth (outermost one) whereas in *obsoletus* the seventh is shorter than the tenth."

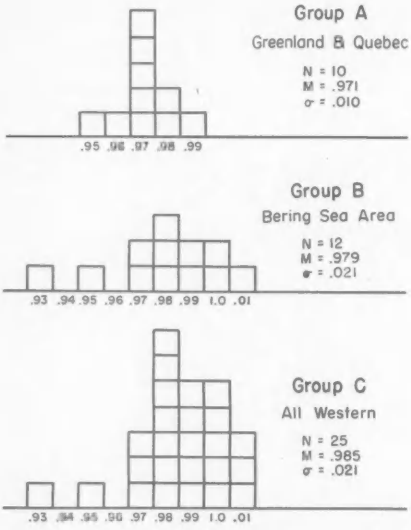

Fig. 42. Histograms showing primary index in different groups of gyrfalcons.

Since there has always been some doubt as to the proper name to apply to specimens collected in far western North America, I have recently checked the "primary index" of 35 Gyrfalcons in the Chicago Natural History Museum, the Museum of Vertebrate Zoology, and the California Academy of Sciences. I am grateful to the curators of these collections for permission to examine them. The two primaries were flattened and measured from the bend of the wing without moving the measuring stick. The length of the tenth primary was divided into that of the seventh to give the "primary index." An index less than 1.00 means that the outermost primary is the longer; an index of 1.00 means that they are equal; and an index of more than 1.00 means that the primary fourth from the outside is longer. Indices found ranged from .93 through 1.01.

The specimens were divided into three groups: A, 10 undoubted *obsoletus* (9 from Greenland and 1 from Orleans Island, Quebec); B, 12 from the Bering coast (3), Bering Sea islands (7), and the east Asiatic mainland (2); and C, 25 "western" birds, including all group B plus 2 from Point Barrow, Alaska, and 11 from British Columbia. At least 10 of the British Columbian specimens were definitely migrants, and some may even have been Asiatic migrants.

An examination of the graph (fig. 42) will show that the birds of group A have a relatively longer outer primary on the *average* and that they are more uniform in primary index. However, it

will also be noted that there is a complete overlap of primary index of group A by group B (as also by the more inclusive group C).

This means that no member of the population represented by group A can be distinguished by primary formula from group B or group C. Also, less than 16 per cent of the population represented by group B, and about 21 per cent of the population represented by group C can be distinguished from group A by this method.

Two explanations come to mind: One, Gyrfalcons disperse very widely in winter, and many *F. r. obsoletus* travel westward, even as far as Asia. This explanation requires either that the population of *uralensis* is small compared to that of *obsoletus*, or perhaps that it winters mainly southwest of its breeding range which is occupied in part by *obsoletus* in the winter. Some such situation would be required to explain the two group B birds with primary indices of .93 (Chicago Museum of Natural History no. 157,001, immature female, collected by George Willett, Unimak Island, Alaska, October 13, 1926), and .95 (Chicago Museum of Natural History no. 102,336, immature (?) male, collected by A. S. Loukashkin, Greater Khingan, Manchuria, Asia, December 5, 1938).

A second explanation would be that though there is a tendency for the primary index to approach or surpass 1.00 in Gyrfalcons of western Alaska and eastern Asia, it is not sufficiently invariable to be a reliable diagnostic character. To me this would seem the more likely explanation. I suspect this tendency may be a cline of average condition, running from somewhere in eastern North America westward perhaps into Asia. This might explain Chicago Natural History Museum specimens numbers 130,764 and 130,765, immature females, collected by A. Eastgate at Nelson, North Dakota, November 1, 1905, with primary indices of 1.02, and 1.00, respectively.

Unfortunately, the specimens available to me are few in number, and only one in group B is probably close to its breeding grounds. This is Chicago Museum of Natural History number 376,636, adult male, collected by L. Stejneger on Bering Island, March 23, 1883, primary index .99—in other words, *obsoletus* according to Todd and Friedmann. (There is also an adult female, collected in April at St. Michaels, Alaska, in the collection of the California Academy of Sciences, of which the primary index cannot be exactly taken, but with the less damaged tenth primary still longer than the corresponding complete seventh.)

Consequently, I am not at all sure that there is a Bering Sea coast population than can be successfully distinguished from *obsoletus*. Perhaps these birds are simply that part of subspecies *obsoletus* in which a primary index of 1.00 or more occurs most frequently. (This is an index value apparently not recorded from Greenland, although if variation in this character follows the normal curve, about two per cent of the population should show it.) This would be exactly comparable to the darkest Labrador phase (which does not occur in Greenland), though the other phases, all found in both Greenland and Labrador, differ only in relative frequency. The solution of this problem will require not only an adequate series of breeding birds from the Bering Sea coast of Alaska, but also from the Bering Sea Islands and from the breeding range of *uralensis* in Asia. In this connection it is interesting to note that Dementiev (Systema avium rossicarum, 1, 1935:1-288) revives the name *F. gyrfalco grebnitzkii* Severtzow for the birds from Kolyma eastward to Kamchatka and the Commander Islands. In other words, further taxonomic work is needed in Siberia to be certain of the proper name to apply to western Alaskan birds if (1) they are subspecifically distinct from *obsoletus*, and (2) are identical with those of easternmost Asia.—R. M. Bond, *Soil Conservation Service, Portland, Oregon, February 2, 1949.*

Behavior of Birds During a Forest Fire.—In the summer of 1943, while serving as a fireguard in the timbered portion of the Saguaro National Monument (Rincon Mountains near Tucson, Arizona), I had a limited opportunity to observe the actions of a few birds during a forest fire.

The Saguaro National Monument includes within its boundaries a good portion of the Rincon Mountains, and in June, 1943, a forest fire burned over most of the area of Transition Zone in the range. During the early period of the fire I was stationed in a high steel lookout tower to report on the progress and directions of the blaze. My duties required a continuous watch but offered opportunities between reports and fire observations to notice the reactions of several species of birds.

Two nests of the Band-tailed Pigeon (*Columba fasciata*) were in plain view of the lookout tower, and the home ranges of a number of other pairs had been roughly determined during previous weeks

on the mountain. Both visible nests were promptly vacated when the first heavy smoke from the fire reached them, and apparently this was also true at the other nests; pigeons could be seen flying up above the low smoke cloud soon after it had penetrated sections of forest. Most of the pigeons headed for distant points after a brief circling above the smoke, but one member of the pair which occupied one of the visible nests (about 150 feet distant from the observer) was seen to return to the nest after about 15 minutes. This was after the first heavy smoke cloud had thinned out considerably. This pigeon was observed again about 30 minutes after it had returned to the nest. It was sitting quietly and was never seen to leave the nest again. In the dense smoke which enveloped the area later, it may have escaped, but so far as I could tell, it perished on the nest.

As the day progressed, the wind, blowing from the fire toward the lookout tower, carried a low, heavy layer of smoke over the area on which the tower was located. The observation cage itself was well above the thickest of the smoke, however, and I could still see for considerable distances. At about this time I began to notice birds moving just above the thick stratum of smoke. Frequently they were close to the tower and I could identify them as Purple Martins (*Progne subis*) and Violet-green Swallows (*Tachycineta thalassina*). The martins far outnumbered the swallows. I estimated as many as 15 martins near the tower at one time. There seemed to be no doubt as to their activities; they were actively feeding. Evidently numbers of strong-flying insects were being driven upward from the forest by the smoke, or weak-flying species were being carried up by the air currents, or both.

The martins and swallows could be seen diving without hesitation into the heaviest billows of smoke, returning to view in a moment, wheeling, skimming and diving in an active feeding manner. Even up to the time when the smoke had become so thick as to make further observations on the fire almost impossible, and the proximity of the blaze forced evacuation of the tower, the martins and swallows could occasionally be glimpsed, still feeding.

Purple Martins had been observed only once or twice during the previous weeks spent on the mountain; they evidently had been attracted from the desert below, where a colony of considerable size nests in the saguaros of the monument area. The martins and swallows were the only living creatures which seemed to profit by the catastrophe.—JOHN R. HENDRICKSON, *Museum of Vertebrate Zoology, Berkeley, California, November 22, 1948.*

Notes on Nest-building of the Vermilion Flycatcher.—A pair of Vermilion Flycatchers (*Pyrocephalus rubinus*) was completing its nest in a cottonwood under which I camped at the San Bernardino Ranch, near Tucson, Arizona, on July 6 and 7, 1947. When discovered the nest was almost completed so that during the heat of the day the female made trips to it only every hour or so. The nest was about 18 feet above ground and built where two small lateral twigs, about four inches apart, came off of one of the main branches of the tree some distance out from the trunk. During a great part of the midday the female perched on dead twigs under the canopy of large willows on the north side of a pond and her brilliantly colored mate did the same in neighboring willows. From these shaded retreats they flew out into the sunshine to catch insects buzzing by, often chasing them in wild gyrations over the pond before finally catching them. Upon having completed a successful mission they returned to one of their favorite perches but not always the same one from which they departed.

Apparently the male took no part in the nest-building activities although occasionally he was observed in the vicinity of the nest. After placing a bit of cobwebby material the female commenced shaping her nest by pushing with her feet and apparently with her abdomen. Her tail while in this position was either held erect or even tilted forward over her back; and her wings, directed upwards, also made a sort of flipping motion up over her back as if they were aiding her in her pushing efforts. Continuing in this fashion she worked counter-clockwise around the outer half of her nest, molding it. On every trip to the nest she worked several minutes from position to position, shaping and enlarging it. These efforts seemed to be directed against the outer part of the nest opposite the side built against the main supporting limb.

Most of the nest-building occurred in the early morning hours, and from my cot just below her I saw and heard her snap strands of spider silk in the central part of the big cottonwood. These she wove into the nest.

During noon of the second day, the male came to inspect the nest-building achievements of the female. He stood on the edge of the almost completed but shallow structure tilting his head from side

to side, and then he gently hopped into it. He tilted his head this way and that as he carefully made his survey. He sat perfectly still, not trying to enlarge the nest as the female had done on every visit. Finally after having remained in the nest for some minutes, he removed a bit of cobweb from the rim on the right side of the nest and carefully placed it on the rim of the nest to his left. Some moments later, he stepped out of the nest and flew back to his favorite perch under the big willow by the edge of the pond.—ERNEST R. TINKHAM, *Tucson, Arizona, May 27, 1948.*

Sixth Record of Gray-headed Junco on Pacific Slope of Southern California.—While Bruce E. Cardiff and I were at Stockton Flats, north fork of Lytle Creek Canyon, San Gabriel Mountains, California, on November 6, 1948, I collected a Gray-headed Junco (*Junco caniceps*). It was with a flock of Oregon Juncos at a dripping water faucet. It proved to be an adult female. The specimen is now no. 732 in the Cardiff collection.—EUGENE E. CARDIFF, *Bloomington, California, February 2, 1949.*

The Hawaiian Dark-rumped Petrel Reappears on Hawaii.—On November 8, 1948, a Hawaiian Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) was caught alive at the north rim of Kilauea caldera at about 4000 feet elevation on the island of Hawaii. The latest preceding record for the species from this island appears to be based on a single specimen in the Bernice P. Bishop Museum, Honolulu, dated 1900. Prior to this H. W. Henshaw (Birds of the Hawaiian Islands, 1902: 119-120) records a juvenal female that came ashore in exhausted condition on the Hilo beach on November 20, 1890. The petrel was collected in some numbers at nesting grounds in the mountains of Molokai in 1907, and two specimens in the Bishop Museum were taken on Lanai in 1926. It is feared that nesting has been prevented since the early 1900's on Hawaii and Molokai by the introduced and abundant mongoose. Obviously, however, the bird has been able to maintain itself somewhere in the archipelago, perhaps on Kauai, where there are no mongooses. Night calls and screams of avian origin and most likely attributable to the Hawaiian Petrel continue to be heard occasionally by residents

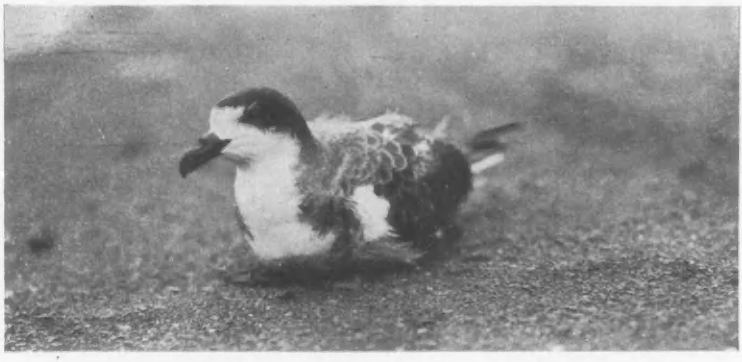

Fig. 43. Hawaiian Dark-rumped Petrel, Hawaii National Park.

of Hawaii. Two instances were reported to us: one in December, 1948, and one in March, 1949, both on stormy nights in the Volcano district at Kilauea. Such calls have been heard in the vicinity of Hilo within recent years, and Henshaw (*loc. cit.*) describes them as of common occurrence there in the 1890's. Nothing seems to be known of the present nesting and feeding areas of this species.

Since the bird is rare in collections and published measurements and descriptions are few, the following data are presented: sex male, testes 4.5 mm., length in flesh 409, wing expanse 992, wing 286, tail 143, exposed culmen 31, least depth of bill 10, greatest depth of bill 12.3, tarsus 36.5, middle toe and claw 44.4. Tarsi and proximal half of feet pinkish flesh color; distal five-eights of web and toes black; entire dorsal portion of outer toe black. Iris dark yellowish-brown. Feathers at base of culmen pure white (they are mottled in *P. p. phaeopygia*; see Murphy, Oceanic Birds South America, 1936:698).

The measurements compare more closely with Bryan's (Occas. Papers, B. P. Bishop Mus., 1908:

142) measurements of 21 specimens from Molokai than with Murphy's (*loc. cit.*) measurements of the Galapagos Petrel (*P. p. phaeopygia*).

This bird came to land at the front of a severe southerly storm. Outwardly it appeared to be in good condition, but its actions were weak, and it died after four days, although force fed. Examination revealed head and leg injuries, possibly suffered at the time of capture or during the period of its captivity. The specimen was mounted for display at Hawaii National Park.—PAUL H. BALDWIN, *Museum of Vertebrate Zoology, University of California, Berkeley, California,* and DOUGLASS H. HUBBARD, *National Park Service, Hawaii National Park, Hawaii, April 6, 1949.*

A Heavily Parasitized Flicker.—On March 31, 1948, I had occasion to collect a female Red-shafted Flicker (*Colaptes cafer*) near Eugene, Lane County, Oregon. Upon opening the coelomic cavity to obtain tissues for histological examination, I found a large number of nematodes present. There were no less than forty roundworms removed, ranging from 150 to 190 mm. in length, having a total volume of about 52 cc. In addition, three acanthocephalid worms were found in the intestinal tract.

Microscopic examination further revealed the presence of embryonated nematode ova near the spleen, ovary and kidneys. Individual ova were found in the renal veins, in the interlobular hepatic veins, and among the intestinal villi. Numerous coccidia were also found in the intestinal mucosa.

Samples of the worms were sent to the United States National Museum for identification. Dr. Benjamin Schwartz of the Bureau of Animal Industry of the Department of Agriculture identified the nematodes as being of the genus *Diplotriaena* and the acanthocephalids as probably being of the genus *Mediorhynchus*. Poor fixation on my part precluded definite specific identification of the nematodes and even made the generic determination of the acanthocephalids uncertain. Dr. Schwartz suggested the species *D. americana* for the nematodes.

Since this bird was actively excavating a nesting cavity at the time of collecting, this heavy infestation of parasites apparently had not interfered with its activities as yet. The ovary was found to contain several developing ova. The bird's stomach contained several hundred yellow-jackets (*Vespula* sp.) and ants.—GORDON W. GULLION, *Richmond, California, January 8, 1949.*

Striped Horned Owl in Southern Mexico.—On July 20, 1944, I collected a female Striped Horned Owl (*Rhinoptynx clamator*) near Tuxtla Gutierrez, Chiapas. At that time I overlooked the

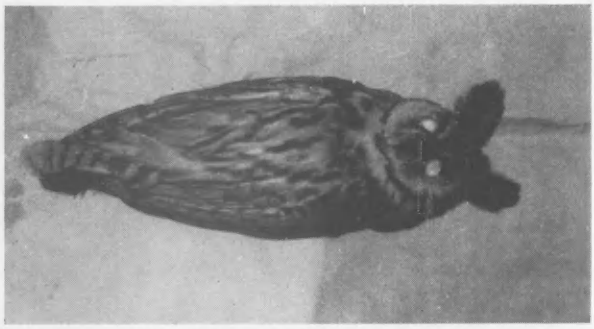

Fig. 44. Specimen of Striped Horned Owl taken near Tuxtla Gutierrez, Chiapas.

fact that this owl has not often been recorded from Mexico. It is now realized that perhaps the record is of interest; to substantiate it a photograph of the skin is presented. The specimen is in my own collection.—MIGUEL ALVAREZ DEL TORO, *Museo de Historia Natural, Tuxtla Gutierrez, Chiapas, Mexico, March 20, 1949.*

An Extension of the Altitudinal Nesting Range of the Pintail in California.—Bodie, Mono County, California, a deserted mining camp, is situated near the mouth of Cottonwood Canyon at an elevation of 8374 feet. This area is typical of the Great Basin; the dominant vegetation is

Artemisia tridentata. The accumulated talus from the abandoned mines has been processed recently to obtain additional gold, and shallow ditches resulting from this work have filled with water, forming small ponds.

In early May, 1948, J. H. Severaid observed a pair of Pintails (*Anas acuta*) swimming and feeding in one of the ponds. On June 18, 1948, when I camped with Severaid at Bodie, observations were made again on the ducks. This time the drake was absent, and the female was accompanied by nine ducklings.

The pool was approximately 30 feet long and 25 feet wide and varied from one to two feet in depth. The neighboring area, a grassy meadow with scattered clumps of *Artemisia*, offered little cover. Nevertheless, according to Robert Bell, the caretaker, the duck nested on the dry ground under one of the *Artemisia* bushes.

Grinnell and Miller (Pac. Coast Avif. No. 27, 1944:77) give the altitudinal range of this species in California as being from near sea level to 6600 feet. This record of nesting at Bodie extends the known altitudinal range an additional 1774 feet.—PHILIP H. KRUTZSCH, *Museum of Natural History, University of Kansas, Lawrence, Kansas, February 5, 1949.*

Gyrfalcon Taken in California.—On October 23, 1948, Robert F. Russell of the Tule Lake National Wildlife Refuge, while hunting quail about two miles west of Lower Klamath Lake, Siskiyou County, California, shot a Gyrfalcon (*Falco rusticolus*) which he later prepared as a specimen and sent to me for study. It is labeled as a male. The seventh primary is shorter than the tenth, indicating its affinity to the race *uralensis*. The plumage is that of an immature bird. This is the first record of this species in California.

Mr. Russell's account of the taking of this specimen is worth quoting verbatim: "I shot the hawk while quail hunting in that area. While searching for a cripple with my setter, I noticed a hawk circling, watching our activities. The bird evidently had no fear of man or dog and seemed to resent our presence—perhaps it was interested in the crippled quail. Suddenly the hawk folded its wings and dropped like a stone toward the dog from a height of about 75 feet. Just before the hawk reached the dog it pulled out of its dive, missing the dog's back by a scant two feet . . . . The speed of the bird was extreme. I can distinctly recall the sound of the wind in its wings as it dove—like someone tearing a sheet. The hawk duplicated its first dive and I shot it as it came out of it."—STANLEY G. JEWETT, *Portland, Oregon, February 15, 1949.*

Loggerhead Shrike Steals Shot Sparrow.—In early May, 1948, my brother and I were collecting birds at a small marshy pond in a grassy field about four and one-half miles southeast of Reno, Nevada. A Savannah Sparrow (*Passerculus sandwichensis*) flew up to a fence post about forty feet from where we stood. My brother shot the bird. The second it hit the ground, we ran to pick it up but were amazed to see a Loggerhead Shrike (*Lanius ludovicianus*) seize our bird and carry it away. The shrike carried the sparrow with laborious strokes of its wings and flew to a spot in a large field of sagebrush about fifty yards away. Because the prey was comparatively heavy, the shrike flew low over the ground. It seems incredible but we could not locate either the shrike or the sparrow after searching the area for at least a half hour.—NED K. JOHNSON, *Reno, Nevada, February 13, 1949.*

Winter Wren in San Diego County, California.—On October 10, 1941, I saw a Winter Wren (*Troglodytes troglodytes*) on Palomar Mountain, northern San Diego County, at an elevation between five and six thousand feet. On November 4, 1941, I could not find any Winter Wrens at the same location.

On March 6, 1949, I saw two Winter Wrens in Marion Canyon, Agua Tibia Ranch, near Pala, northern San Diego County, California, at an estimated elevation of three thousand feet. The birds gave the loud alarm note and one individual could be seen to curtsy with each double note as it perched in a blackberry tangle. This bird was observed at about twelve feet with binoculars. When the bird moved from one hiding place to another, its small size and the angle at which it held its tail could be noted.

It seems possible that the Winter Wren ranges regularly farther south in California than San Dimas Canyon near Pomona, Los Angeles County, which Grinnell and Miller (Pac. Coast Avif. No. 27, 1944:330) cite as the "southernmost recorded station for wintering" of this species.—ELEANOR GUYER BEEMER, *Pala, California, March 17, 1949.*

NOTES AND NEWS

Fig. 45. Josselyn Van Tyne, vice-president of the American Ornithologists' Union and editor of the Wilson Bulletin from 1939 to 1948.

The colored frontispiece of the Black-bellied Tree Duck (*Dendrocygna autumnalis*) is presented through the generosity of J. R. Pemberton. Readers of the Condor are greatly indebted to him.

The 1949 meeting of the American Ornithologists' Union will be held October 10 to 14 at Buffalo, New York.

The 10th International Ornithological Congress will be held at Uppsala, Sweden, June 10-17, 1950.

The report on the winter concentration of Band-tailed Pigeons in central California which follows was written by Mr. Ian I. McMillan. He is a wheat rancher in eastern San Luis Obispo County and has always been a resident of that area.

THE CONCENTRATION OF BAND-TAILED PIGEONS IN CENTRAL CALIFORNIA IN 1949

During January, February, and March of 1949, an unusually large concentration of Band-tailed Pigeons (*Columba fasciata*) occurred in different areas within a radius of 150 miles of Paso Robles, San Luis Obispo County, California. This area is in the upper Salinas River drainage of central coastal California.

Of a similar occurrence in the fall and winter of 1911-1912, Dawson ("The Birds of California," vol. 3, 1923:1155) wrote: "Immense numbers of Band-tailed Pigeons appeared in the interior valleys of Santa Barbara County, centering about the town of Los Olivos. It is probable that practically the entire summer population of California north of Tehachapi, Oregon, Washington, and British Columbia concentrated at this point .... What followed on this occasion was a humiliating example of what human cupidity, callousness, and ignorance, when unrestrained, will accomplish toward the destruction of birds. Reports of the birds' abundance spread rapidly .... Hunters from the outside flocked to the scene. Every gun was put into commission. By automobiles and trainloads they came. The country was aroar with gunfire .... Farmers urged in extenuation of this slaughter that the pigeons do damage to their grain fields. It is true, according to investigations carried out by Mr. Stanley G. Jewett in Tillamook County, Oregon, that the pigeons visit newly planted oat-fields and gather grains scattered upon the surface. Such grain, as Mr. Jewett points out would not mature anyway; and since the birds neither scratch nor delve, the damage done is immaterial. It is another case of hunting excuses."

Of the same 1911-1912 debacle, W. Lee Chambers (Condor, 14, 1912:108) wrote, "Band-tailed Pigeons were abundant this winter from Paso Robles south to Nordoff, all through the Coast Range of Mountains. One hunter from Los Olivos shipped over 2,000 birds to the San Francisco hotels. The morning train from San Luis Obispo to Los Olivos on Sundays averaged 100 passengers who came to hunt pigeons .... these hunters averaged about thirty birds apiece per day .... What can be done?"

Grinnell (Condor, 15, 1913:35) stated, "It is probable that an unusual concentration of the pigeons from the whole Pacific Coast region into a district easily reached by hunters gave exceptional opportunity for the infliction of the slaughter above recounted. The weak place in the pigeon's defense thus comes when conditions of restricted food supply force it into localities where its survival depends upon whether or not hunting is sanely regulated. Obviously, suitable legislation must be enacted at once, before chance of a repetition, even in lesser degree, is afforded."

For 20 years following the 1912 slaughter the Band-tailed Pigeon was given total protection as a game bird. In 1932 shooting seasons were resumed and in 1948 shooting of pigeons in central California was allowed from December 1 to 15. On the opening day a great many pigeons were found to be occupying a relatively small area west of Templeton, California, and for four days, according to reliable reports, "anyone could get their limit." On Sunday, December 5, one hundred cars were parked along one-half mile of narrow road in this area, and what was estimated to be four hundred hunters were occupying a small area adjacent to this road. Few birds remained by this time, however, and these few drew a continual bombardment as they remained high out of range. Pigeons remained scarce throughout the area for the remainder of the hunting season.

In January, 1949, coincidental with an unusually severe period of cold weather, pigeons in large numbers began appearing not only in their usual winter territory but in nearby areas where ordinarily they are seen rarely. Food was abundant in the form of waste grain that remained on the ground after the last season's harvest activities and also available was the small percentage of seed grain that ordinarily fails to get covered in the process of winter planting.

The pigeons' activities while obtaining this food, in addition to grain found in the crops of pigeons killed, was used as proof of damage and on this basis, the authorities in charge issued permission to shoot the birds. Permits were issued orally and in some cases by telephone to anyone claiming damage to their crops, and these permittees were also provided with permits to issue to outsiders to shoot on their property. What ensued was a repetition of the almost forgotten debacle of 1912.

The facts of what actually took place for two months following this first shooting are extremely hard to ascertain and for the most part unavailable as presentable evidence due to their incriminatory nature and the confidence in which they have been obtained. A great many birds shot by those who had permits were not reported and a great many birds are known to have been shot by hunters who had no permits. From the time this shooting started about the middle of January, as far as can be ascertained, there were no arrests for violation of laws protecting Band-tailed Pigeons in San Luis Obispo County, until February 20, when the first effort to establish law and order resulted in the arrest of 14 hunters all of whom had come a distance of 112 miles to shoot pigeons and who had no permits.

As further evidence of the amount of shooting, the area involved, and the attitude of the authorities in control, the following items are considered to provide an accurate description.

A report on the front page of *San Luis Obispo Telegram-Tribune*, February 7, 1949, among other things, stated the following: "A winged pestilence—in the form of thousands of wild pigeons —has descended on farmers in the upper Salinas Valley, . . . Farmers . . . have declared war on these robbers. The pigeons are fat as hens, and are said to be choice eating . . . . Steady shooting on both sides of the highway was reported in the vicinity of Atascadero."

A headline article in the *Paso Robles Press*, issued February 22, 1949, included the following statements: "Typical of the ranchers most severely hit by the flocks of birds, Henry Jaster, of the Chimney Rock Ranch west of Paso Robles, said Saturday that he has had more than 300 acres of seeded grain ruined by the band tails . . . ."

In the *Santa Barbara News Press*, about the middle of February, under the caption "Sportsman's Paradise" appeared, among other statements, the following: "Wild pigeons by the thousands early this week were continuing to flock to tender young grain fields in the Tri-Counties in an unseasonal migration which caused: A flood of requests for permission to shoot the birds in an effort to stop the damage . . . . Game Warden R. E. Bedwell said that, although he has received many requests for federal permits to shoot the birds, after an examination of the situation in the fields he has wondered why he has not received many more such requests. 'When ranchers are as short of feed as they are this year I don't blame them for not wanting to lose it to birds,' he said. He said he had seen pigeons by the thousand

settle on grain fields and denude them of their tender young shoots."

As evidence of how the policy of managing this problem was established, the following statements in a letter from Orben Philbrick, game warden of the California state fish and game patrol, Paso Robles, are explanatory: "Shortly after I received the first complaints of damage, Game Management Agents, Hugh Worcester, and Harry Latimer, from the Berkeley Office, A. W. Elder, Game Management Agent from the Los Angeles Office, and Mr. Lostetter, Depredations Officer for the Fish and Wildlife Service, Berkeley, met at my home in Paso Robles, these gentlemen, accompanied by Captain Hecker, Warden Fullerton, and myself investigated thoroughly several areas where damage was being claimed, after said investigation it was their very decided opinion that there was sufficient damage, and the prospects of more, to warrant the issuing of permits to shoot the birds, and to further provide permits that the permittee's could issue to outsiders to shoot on their property. This procedure was favored, rather than an open season to the general public, and I believe a wise choice . . . . Other members of the Patrol force, as well as myself, have in the past, as well as during this epedemic, made some very careful checks, on birds killed in various areas, which provide some interesting figures, by actual weight a pigeon will eat from 1½ to 2 ounces of grain per day, so to keep well within the limit we will say 1 lb. of grain to 10 birds, per day. Now to take the Agents figures of 650,000 birds in the area, gives us a total of 65,000 lbs., or 32½ tons of grain per day, which seems to me over a period of some 25 or 30 days, could reasonably be considered damage, to say nothing of the possibility, and from reports, a certainty that they are eating almond buds . . . . As to Mr. Jewett, whom you cite as an authority, I can only say that of my own personal knowledge I do know that pigeons will pull out sprouted grain, and that they will dig it out with the bill."

It is a foregone conclusion that as a result of this management policy not less than 100,000 pigeons and probably a great many more have been killed. In addition to the previous news reports this conclusion is based on evidence such as the following facts: Shooting had prevailed for at least sixty days; for thirty days at the time this concentration was at its peak no control whatsoever was in evidence. On one ranch having only two hundred acres of grain, it had been ascertained that from ten to twenty hunters were shooting every day for forty-five days or more; two of these hunters left after two days of shooting with two hundred pigeons; it is known that one hunter from a blind in the form of a fifty-gallon drum shot one hundred and thirty-five pigeons at one sitting; it is known that hunters came from most of the large cities within 250 miles to shoot; reliable reports of individuals shooting from seventy-five to one hundred pigeons in one day were common; local ammunition dealers reported a demand for shot-gun ammunition surpassing that during recent hunting seasons.

On March 31, 1949, the shooting permits expired. The crops involved in the damage claims were, at this time, well above the ground. As far as has been ascertained in a search for conclusive evidence, not one iota of damage to planted grain in eastern San Luis Obispo County has been found. This fact is further established by the following:

A letter from Mr. Thomas Chalmers, Agricultural Commissioner, County of San Luis Obispo, contains the following: "During the period of pigeon concentration in the Paso Robles District, this office received no requests for aid to this problem. Nor were we consulted by any agency to determine if, in our opinion, pigeons were actually destroying any crops, although one of the primary functions of this office is the control of pests . . . . There are 200,000 acres planted to grain and hay in this county and a very large portion of this acreage is found in the district traversed by pigeons. Very soon after losses were being reported, I instructed the men of this office to observe the action of these birds and to appraise the loss being caused to these crops. The conclusion of our observation of the extent of damage is that it was confined to grain remaining upon the surface of the ground after planting operations had been completed. The removal of this grain from the surface of the ground will not affect the yield of these crops to a measurable degree. No acreage so far as we have been able to determine has been damaged so that replanting was necessary . . . . The irony of this problem is that a delay was made by us in the start of the application of grain treated with 1080 poison in areas where the pigeons had concentrated. This work of controlling ground squirrels was delayed until tests and observations were completed as to the danger of this material to these birds. Our tests clearly proved that none of these birds would be killed. Although this care was being taken, a slaughter of pigeons was being permitted without the proof of serious damage."

Egmont Z. Rett, Curator of Ornithology and Mammalogy, Museum of Natural History, Santa Barbara, in a letter dated February 14, 1949, to the Director, State Department of Natural Resources, stated: "I would like to pass on to you a report of indiscriminate shooting of Band-tailed Pigeons in the Salinas Valley. It seems that permits have been issued without thorough investigation. The permits have evidently been given because of supposed damage to grain in the area north of Paso Robles. Pigeons are not scratching birds and therefore the only grain they are eating is that which has been spilled or otherwise not covered . . . ."

A preliminary report of pigeon damage survey, as delivered at a meeting of the Cholame Township Sportsmen's Association, February 24, 1949, by Fred Ross, Game Manager, Bureau of Game Conservation, California Division of Fish and Game, contained the following statements: "Papers by Jewett, Barnes, and Neff, have dealt with fruit damage, as well as alleged grain damage. This printed material was apparently overlooked in the hysteria which developed as the first pigeons hit the grain fields here . . . . Although my study has not yet progressed far enough for me to present you with seed counts and weights, I am prepared to state that out of a tow-sack full of grain taken from pigeons, only a small double-handful was found to be cleaned grain. I feel that this small percentage also represents waste grain, accidentally left uncovered in the planting process . . . . It is contended by some that the pigeons pull up the grain after it has sprouted. Hours of patient observations in the field have not yet disclosed any pigeon pulling up sprouts . . . . It is very true that some sprouted grains are found in the crops collected, but closer observation reveals the sprouts to be green all the way back to the seed, while sprouts which have come up through the ground are pale white from the seed to a point varying with the depth of planting. I also spent several days, in many fields, crawling and examining the ground minutely for holes or other disturbances which would indicate sprouts could have been pulled. I found no such evidence. To further investigate the matter, I sifted and counted all seeds from small plots in every field visited, some immediately behind the planters and some in areas supposedly ravaged by pigeons. I found no substantial difference in seed counts per foot, considering of course that some planters sow more pounds per acre than others. One plot, 10 ft. by 20 ft. was also covered with netting immediately behind the planter to give it complete protection from the birds. The yield of this plot will be weighed against yield of a plot of equal size in a spot visited heavily by pigeons. This should give us some very useful information."

While it may seem incredible that the combined opinion of these and other qualified observers was given no consideration in the management of this problem, equally as incredible is the fact that the recorded findings of every recognized authority on the food habits and behavior of the Band-tailed Pigeon were also either ignored or overlooked. As has been previously brought out in this paper, government representatives participated and were in accord with the establishment of this policy of shooting to protect grain crops, it is therefore quite surprising and confusing to read in a government publication the following statements of Johnson A. Neff ("Habits, food, and economic status of the Band-tailed Pigeon," North Amer. Fauna 58, 1947:39):

"Munro (1924) reported on an investigation of band-tailed pigeon damage in British Columbia as follows: 'On June 9, 1923, I had occasion to investigate a report that band-tailed pigeons were causing damage to sprouted wheat . . . . About eight acres of the meadow had been seeded to wheat and oats by hand and as always is the case with this method of sowing, a large percentage of the seed was on the surface. This exposed seed had germinated . . . . Close observation with binoculars showed that only surface seed was being taken, the young plants from buried seed were not pulled up.'

"Mrs. Florence Merriam Bailey (1928) writes: 'On the west side of Moreno Valley, on July 4, 1919, Mr. S. E. Piper discovered that two or three thousand Pigeons had congregated along the borders of a deep cove. He was attracted to the place by heavy shooting on the part of the ranchmen—mainly foreigners who said that the birds destroyed their young grain, especially barley. On examining several areas from which the birds rose, Mr. Piper could find no indication that they were either digging or pulling the young grain; . . . It was evident that the hunters were seeking justification for shooting them . . . .'"

While evidence is plentiful that this needless killing was opposed by various organizations and individuals, there is little evidence that the authorities heeded this opposition. W. Andy Anderson, sports writer, in a column in the *San Luis*

Obispo Telegram-Tribune, wrote on February 23: "Protecting crops is one thing, and slaughtering game is another. The arrest of 14 illegal shooters in one day illustrates how easily the present pigeon situation could be changed into a slaughter. The fact that they were from as far away as Bakersfield adds more to the picture. Before this valley invasion some southern California gunners had their inning. The trouble is that those arrested represent only a small percentage of the hunters who have climbed on the 'save-the-grain' bandwagon. Someone bungled somewhere. When the news spreads throughout half the state in two weeks that there is an 'open season' on pigeons in this county—something's wrong."

The *Paso Robles Press,* March 1, 1949, contained in a front page news item the following: "Despite the explanation offered on behalf of both state and federal authorities with regard to the pigeon shooting permits issued in this area, the Cholame Township Sportsmen's Association has passed a resolution highly critical of the entire procedure. At their meeting Thursday night . . . the following resolution was proposed and adopted: 'The Cholame Township Sportsmen's Association is dissatisfied with the recent management of the pigeon situation in this area. We believe that the issuance of permits in the present setup has resulted in privileged shooting and that alleged damage to crops has been greatly exaggerated. We believe that the conclusions on which this management was based were hastily and ill arrived at. We therefore request an impartial and thorough investigation of the entire situation to clear up misunderstanding and in order to avoid similar excesses in the future.' "

At a meeting of sportsmen in Porterville, March 6, 1949, the authorized spokesman for the Cholame Township Sportsmen's Association stated:

"What is probably the entire population of Band-tailed Pigeons of the Pacific States and British Columbia has been for the past two months wintering in an area within 150 miles of Paso Robles, California. On what now appears to have been circumstantial evidence and erroneous conclusions these birds have been declared a pest and have been slaughtered by the thousands. Adverse weather conditions have forced these pigeons to seek food on stubble fields and planted grain fields where they glean only the waste grain that is on the surface and therefore of no material value. While thus struggling to survive in unfamiliar surroundings they are unusually vulnerable to gunfire and as far as law enforcement or government control was concerned they could have been exterminated right in our midst."

The futility of these public protests is proven by the fact that on March 31, 1949, after the planted grain fields were covered with an ordinary stand of new growth, Band-tailed Pigeons were still being shot through official permission in the Paso Robles area.

As to the advisability of allowing state authorities to liberalize the shooting of Band-tailed Pigeons, it should be realized that we in California must assume a major part in the conservation of this game bird. The following statements of Joseph Grinnell (Condor, 15, 1913:37) are as logical and sound today as when written 36 years ago:

"The Band-tailed Pigeon has been reported in greater or less numbers from widely separated localities, from the Rocky Mountains to the Pacific, and from British Columbia to Mexico. Yet the evidence at hand leads to the belief that all those birds breeding within the Pacific Coast region from Vancouver Island south to the Mexican line, concentrate during the winter season in the valley and foothill sections of west-central and southern California. It becomes clearly apparent, therefore, that California holds the key to the future of the species as far as the Pacific slope is concerned.

"Because the pigeon is broadly scattered throughout the forests and mountains of the whole Pacific district during the summer, it is not at that season particularly liable to decimation. But it is during the winter, when the birds are forced by uneven food supply into small areas in central and southern California, that there is a chance for almost unlimited destruction by hunters, such as occurred in the late winter of 1911-12."

It is natural that a concentration of pigeons such as occurred in 1949 should establish in the minds of a great many people the assumption that the wild pigeon population had greatly increased. The birds' vagrant wanderings over areas where they are not commonly seen, their long spectacular flights from roosting territory to feeding grounds, their gregarious feeding activities in large conspicuous flocks and sporadic concentrations at different times and places, and the general interest and publicity they aroused in connection with hunting, palatability, and crop damage all contributed to the illusion that there were "millions of pigeons." It was noted that these flocks used a particular feeding ground for lim-

ited time only and where seen in great numbers one week would be almost totally absent a week later, while a concentration would appear in another area where previously few birds were observed.

It was ascertained that the large flocks of pigeons that fed on the stubble fields ten miles east of Shandon arrived from a westerly direction in the morning and disappeared in the late afternoon toward the same direction. It is quite probable that these birds returned to roost in the live oaks 40 miles to the west and in that long flight established the popular but erroneous impression that "pigeons were everywhere."

It is also very probable that these same flocks, as they later moved north in migration to their summer range, were responsible for the succession of reports of "millions of pigeons" along their migration route.

Furthermore it should be borne in mind that Band-tailed Pigeons normally raise but one young a year. This factor, together with normal mortality and the numbers shot each season, would prohibit any sudden eruption in the population.

In consideration of the above-mentioned factors and the tremendous increase in hunting pressure during recent years throughout this species' range in the Pacific states, and, furthermore, in view of the great numbers known to have been shot during the past hunting season, until accurate and reliable research presents conclusive proof of excessive numbers, any move to liberalize the shooting of Band-tailed Pigeons should be opposed by all who would wisely manage our wildlife resources.

While the many weaknesses that were brought to light in this emergency should all if possible be eliminated, it was evident that the palatability and food value of the wild pigeons together with the fact that they could be used for food by anyone, were the responsible factors for the almost universal participation in this slaughter. In view of this, the following paragraph contained in the official publication of the Fish and Wildlife Service cited above, "Habits, food, and economic status of the Band-tailed Pigeon" (p. 50), is of particular importance:

"The issuance of permits to kill pigeons that that are damaging crops has never been completely successful. Earlier authorization allowed the owner or lessee to use the birds so killed for food, and as a result a great demand for permits developed, the desire to hunt being the primary motive. Hence permits no longer include the privilege of utilizing the birds killed as food, and significantly there has been a great decrease in the number of complaints. During recent seasons it has been possible in some areas through agreement between Federal and State officials to require the permittee to preserve the pigeons killed for delivery to charitable institutions or hospitals. This has effected further decrease in the number of requests for permits."

Fig. 46. A grain field in San Luis Obispo County, June, 1949. In February, this field, then recently seeded, was visited by tremendous numbers of Band-tailed Pigeons. The stand of wheat in June indicates no damage by these birds.

It is a foregone conclusion that had this requirement been in effect during the 1949 problem, only a negligible amount of shooting would have been done. Why it was not applied has not been ascertained. It should immediately be reestablished, and under no conditions should Band-tailed Pigeons be used as food except by charitable institutions or hospitals, or after being taken legally during the open season.

The fact has definitely been established that on areas allegedly devastated, normal stands of grain have materialized (fig. 46). Band-tailed Pigeons take only grain that is on the surface and do not pull out sprouted seed that has been properly covered. Permits to kill them in protection of recently planted grain crops should not be issued.

In emergencies such as arose during this concentration, it is of particular importance that all available facilities and resources that have been provided to manage such situations be put to use. It is firmly believed that had the capacities of local agencies cited above been applied to this case, apprehension and hysteria that developed as a result of erroneous information would have

been prevented. It is therefore recommended that closer cooperation be established between these agencies and those in charge of wildlife conservation.

It is a recognized fact that pressure of privilege-seeking individuals and groups, as well as the obligations and prejudices that may develop through long established social and commercial relationships, have a degrading influence on the administration of game laws. In order that those responsible for this administration may more ably withstand this pressure and influence, it would seem advisable to establish a program in which game wardens would not remain in charge of a particular area indefinitely.

Public opinion more than any other factor influences conservation. It has been noted in this investigation that when aware of the facts, the public is opposed to wasteful killing of wildlife. In view of misleading public information and refusal of officials to issue requested information pertinent to this case, it is recommended that factual and straight-forward replies to sincere requests for information be made mandatory and that any policy to hide in secrecy the issuing of special permits to kill game be abolished and information regarding these permits be made available to the public.

In conclusion it may be stated that what happened to the Band-tailed Pigeons in central California during 1949 was ample proof that only by careful management can this game bird survive long. Rules and regulations in themselves, as was proven in this case, are worth little as guarantee against such debacles. The only real assurance that such affairs will not be repeated is a firm and abiding realization on the part of those in charge of the conservation of our wildlife that such mismanagement will not be tolerated. On the date of this writing, June 25, 1949, the fields of grain and orchards laden with almonds stand in mute but final evidence of a colossal mistake.—IAN I. MCMILLAN.

COOPER CLUB MEETINGS

NORTHERN DIVISION

MAY.—The regular meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, May 26, 1949, at the University of California, Berkeley. The following proposals for membership were read: Mrs. Sarah E. Banning, 1810 Arch St., Berkeley 9, Calif., by Junea W. Kelly; Mrs. Lawrence T. Burgh, 305 Marion Apts., 1263 Oak St., Eugene, Ore., by Gordon W. Gullion; Richard C. Harder, Box 136, Baldwin, Kan., by Chas. G. Sibley; Robert H. Jamieson, 761 West St., Reno, Nev., by Frank Richardson; Mrs. Milton S. Ray, 609 Arballo Drive, San Francisco 27, Calif., and Mayard Whitney Read. Upper Dogwood Lane, Rye, N.Y., by Alden H. Miller; Herbert Wong, 135 8th St., Oakland 7, Calif., by H. E. Childs, Jr.

Dr. Carlton M. Herman, of the California Division of Fish and Game, spoke on the "Current Status of our Knowledge of Disease in California Quail."—HOWARD L. COGSWELL, *Secretary*.

SOUTHERN DIVISION

MAY.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held May 31, 1949, at the University of Southern California, Los Angeles. The following names were proposed for membership: John J. Cleary, 2806 Glen Ave., Altadena, Calif., by Mary M. Erickson; Mrs. Constance S. Friesen, 1334 N. Euclid Ave., Upland, Calif., by Junea W. Kelly; J. E. Piercy, Denman Island, B.C., Canada, and Winifred S. Sabine, Deep Springs, Calif., by W. Lee Chambers; Richard M. Ritland, Dept. of Biology, Atlantic Union College, South Lancaster, Mass., by John McB. Robertson; Grant K. Roth, 5445 Hillcrest Dr., Los Angeles 43, Calif., by A. H. Miller; Dorothy E. Sheffler, 4731 Angeles Vista Blvd., Los Angeles 43, Calif., by E. N. Harrison; Arnold Small, 1840 W. 11 Pl., Los Angeles 6, Calif., by K. E. Stager; Mrs. S. E. van Zandt, 1405 Grant St., Berkeley 3, Calif., by Edna Elden Williams; Cynthia Ainsworth, 244 St. Albans St., South Pasadena, Calif., Clowes M. Christie, 4719 Angeles Vista Blvd., Los Angeles 43, Calif., and Gerald B. Thomas, 5519 Ruthelen, Los Angeles 37, Calif., by W. J. Sheffler; Mrs. Ruth W. Cox, 418 S. Holt, Los Angeles 36, Calif., Charles W. Hamilton, 2304 Goldsmith, Houston 5, Texas, Eliza Mabel Kelley, 71 Division St., Newport, Rhode Island, S. Paul Lindau, 108 N. Harvard Blvd., Los Angeles 4, Calif., Miss Mildred McElroy, 404 Gladstone Blvd., Shreveport, La., Charles R. Shaw, Rt. 1, Fairfield Apts., Minden, La., Mrs. Paul M. Sullivan, 5281 Woodlake Ave., Woodland Hills, Calif., and David H. Thomson, Calif. State Polytechnic College, San Luis Obispo, Calif., all by C. V. Duff.

V. D. Hale of Ducks Unlimited showed two colored sound-films depicting some of the Canadian marsh areas and one in Arkansas where much of their conservation work is being done.—DOROTHY E. GRONER, *Secretary*.

For Sale, Exchange and Want Column—Each Cooper Club member is entitled to one advertising notice in any issue of The Condor free. Notices of over 5 lines will be charged for at the rate of 25 cents per line. For this department, address SIDNEY B. PEYTON, *R. D. No. 2, Box 260, Fillmore, California.*

FOR SALE—Diseases in Captive Wild Mammals and Birds, by Herbert Fox, M.D. (Phila., 1923), publ. at $12.00. A few copies left at $7.78, postpaid. California purchasers add 19¢ sales tax.—F. N. BASSETT, *722 N. Orange Drive, Los Angeles 38, California.*

WANTED—Auk, vol. 1, nos. 2 and 3; vol. 2, nos. 2 and 4; vol. 3, no. 4; vol. 4, no. 1; vol. 5, nos. 1 and 4; and vol. 6, nos. 1 and 3. Also Bulletin of the Nuttall Ornithological Club, vol. 1, July and October, and vol. 2, July and October. Will pay good price for wanted issues or entire volumes.—IRA N. GABRIELSON, *Wildlife Management Institute, Investment Bldg., Washington 5, D.C.*

FOR SALE—Bent's Life Histories, bulletins nos. 113-195 incl., fifteen volumes, all numbers in excellent condition. Make an offer.—VICTOR E. JONES, *Idaho State College, Pocatello, Idaho.*

FOR SALE—Four-year bound set of the Kentucky Warbler, 1920-1924, with title page and index to authors and birds. Price, $7.00.—KENTUCKY ORNITHOLOGICAL SOCIETY, *% University of Louisville Library, Louisville 8, Kentucky.*

AVAILABLE—Nuttall Bulletins, vol. 1, no. 1, vol. 2, no. 1 (reprints). Also available, vol. 2, no. 2; vol. 4, nos. 1, 2, 3, 4; vols. 5 and 6, each bound. Want vol. 1, nos. 1 and 2.—ROSARIO MAZZEO, *120 Elm Street, North Cambridge 40, Massachusetts.*

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WANTED—Ridgway's Birds of North and Middle America, vol. II, or pages 1 through 16 thereof, to replace a defective copy.—R. W. STORER, *University of Michigan, Museum of Zoology, Ann Arbor, Michigan.*

FOR SALE—Atlas de Filipinas, 1899, as reissued 1900 by Coast Survey, 30 colored maps, 13 by 15 inches, cloth, $16.00; The Osprey, orig. covers, first series vols. 1 to 5, new series vol. 1, nos. 1 to 7, final number 7 never distributed, complete set, $22.00; Revealing and Concealing Coloration in Birds and Mammals, by Theodore Roosevelt, 1911, paper, 112 pages, $6.00.—H. H. T. JACKSON, *Room 61, U. S. National Museum, Washington 25, D.C.*

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